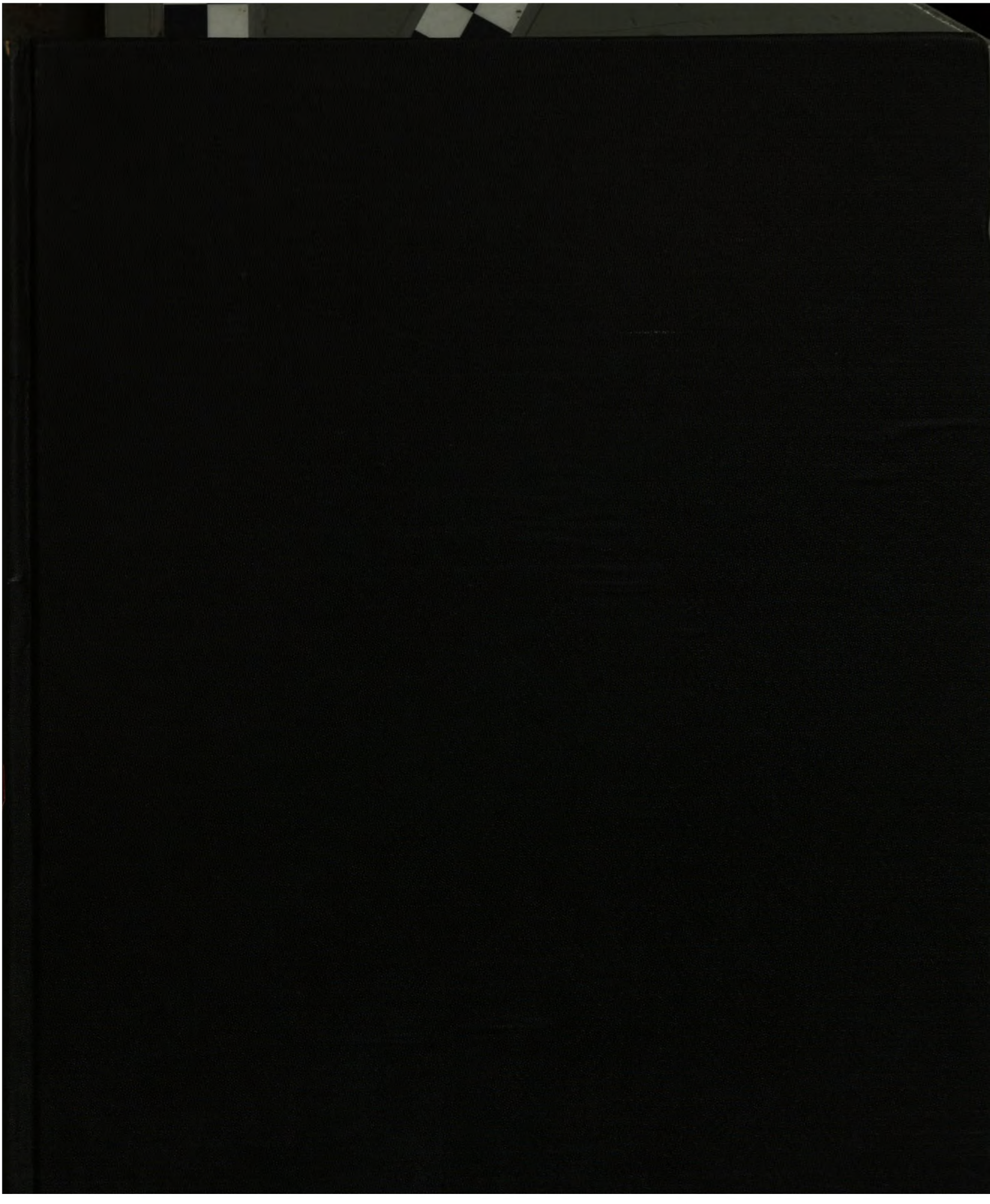

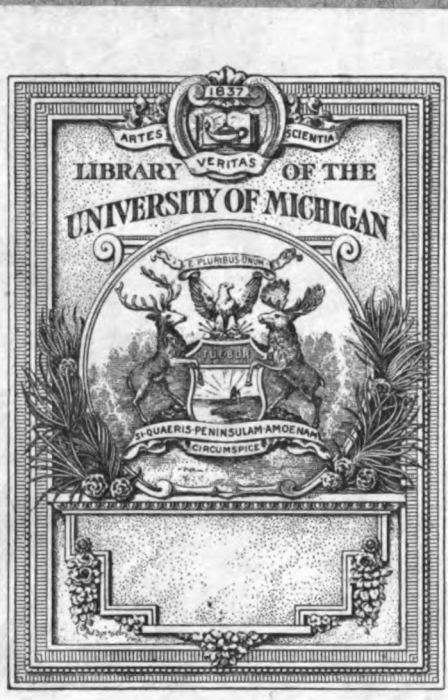
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*A BI-MONTHLY JOURNAL DEVOTED TO MEDICAL, SURGICAL AND SANITARY WORK IN THE TROPICS*


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# Original Communications.

## ZAMBESI ULCER.

A Short Description of an African Disease.

Since coming to the Zambesi delta I have been struck by the number of cases one meets of an ulcer which I do not remember to have seen before, nor to have found described in any publication.

The main points about it are:—

(1) It is met with, with rare exceptions, in one part of the body—below the knee.

(2) It is usually single, rarely double, and more rarely in the form of two, or perhaps three, small ulcers on the same leg.

(3) It does not spread, but exhibits immediate sloughing of the area attacked, remains a week or more, and then heals by granulation.

(4) It produces no constitutional disturbances nor enlargement of the lymphatic glands.

(5) It is invariably associated with the presence of a spirillum and a large fusiform bacillus.

This troublesome ulcer is well known to employers of labour on a large scale in this country, as they have always a few otherwise able-bodied men off duty with it. It is said by natives that one attack gives considerable protection but not complete immunity, as years later the same person may develop mild small ulcers. It is said by them also to be met with only in the flat grass lands, such as the Zambesi delta, but this statement is not to be accepted as reliable.

I find, however, that those who come to work here from the more rocky country higher up the river suffer greatly from it, whereas the local people of the same race are hardly ever attacked, being, I presume, protected by having previously suffered from it.

Reverting to the points enumerated above, I may add as regards:—

(1) *Situation.*—The rarity of appearance anywhere but on the foot or lower two-thirds of the leg is striking, and should throw some light on the manner of transmission.

The disease chiefly attacks field workers, and they certainly get more cuts and scratches about the legs than elsewhere; but there are other breaches of surface, and if the process were a direct contagion one would expect to find a proportion of cases where the lesion was on the face, trunk, or arms, owing to the custom these people have of sleeping packed together, wearing one another's clothing, and rolling, practically naked, on the ground where the discharge must often have contaminated the earth, the mats, and so on.

(2) *Description.*—In its typical form it is a single, shallow, punched-out, round or oval ulcer, about the size of a florin, with a slightly undermined edge, a soft base, and a flat purple-coloured floor. A few show a fungating mass, others vary greatly in size—from a hole in which a large pea would fit to a patch extending more than half round the leg—others, but they are rare, are multiple, and then the individual ulcers are small.

(3) *Progress.*—I have not seen the onset, but there appears to be a tender œdematous local swelling one day, and the next a slough in the middle of it. This disintegrates, and the cavity left—which is only skin deep, but looks deeper on account of the raised edge like that of the ankle-hole of a Cline's splint—fills up with a purple gelatinous material resembling the blood-stained mucus in a dysenteric stool. In a smear it looks like sputum, and is almost entirely free from bacteria, except the two mentioned.

The swelling gradually subsides, giving a flatter appearance, the colour becomes bright red, and granulation finishes the process of repair. The active stage is sometimes over in four or five days, more usually ten to fifteen, but may last two or three weeks, the longer stage being the period of granulation, which is slower than that where an equal area of skin is destroyed by injury.

When a toe is attacked it frequently heals without terminating the disease, the result being an alarming swelling of the foot that breaks through somewhere else or causes the toe to break down again. Some cases would give the impression of spreading if not seen every day, as, after remaining unchanged with an unhealthy edge for days, they suddenly enlarge by the sloughing of a ring round them, after which the larger ulcer so formed heals.

(3) *Effect.*—Although the neighbouring glands are not affected in the ordinary way, a mass in the crural region may be infected with or without an ulcer, forming what is locally known as a "boil," and either subsiding again or suppurating.

(5) *Parasites.*—I have not cultivated the bacillus nor spirillum, and there is no direct evidence that they are the cause of the condition; but their invariable presence in numbers, with marked scarcity of other bacteria, gives considerable probability to the assumption that they are.

With further time I hope to collect statistical and other data on which one may found a working theory for the prevention of this petty but annoying disorder.

*Vicenti,* W. J. Bruce.
*Zambesia.*

## THE ISOLATION OF A PARATYPHOID BACILLUS FROM A DRINKING-WATER SUPPLY.

By Aylmer May, B.A., M.D. (Dublin), D.P.H.

*Principal Medical Officer North-Western Rhodesia; late Government Bacteriologist, Transvaal; from the Government Laboratories, Johannesburg.*

The isolation of the typhoid or paratyphoid bacillus from the small quantities of water used in the routine examination for the estimation of the bacterial content and for evidences of contamination is probably only possible when dealing with a water showing a low bacterial content, and uncontaminated even to a small extent by either sewage or fæces, and even then must be largely due to chance.

The following is an account of the isolation of a paratyphoid bacillus—in the first place, during the routine examination above mentioned, and in the second place by a special process from a drinking-water supply, which did not show either a bacteria

content or indications of excretal pollution sufficient in themselves to condemn the water as unsuitable for drinking purposes.

The first sample was examined in the routine manner employed in these laboratories, which is as follows:—

The sample is planted on agar and gelatine in quantities usually of 0·5, 1·0, and 5 c.c. The dishes are incubated, respectively, at 37° C. and 20° C. for twenty-four hours, and the colonies of bacteria which have then developed are enumerated and the results expressed in the number of organisms per cubic centimetre growing at these temperatures. Glucose-formate broth tubes (Pakes) are inoculated with amounts of 1, 3, and 6 c.c., respectively, and incubated anaerobically at body temperature; after twenty-four hours those tubes which show growth are examined microscopically, and if coli-like bacilli —as shown by their morphology, motility, and staining reactions—be present, endos-agar plates are prepared from the growth. These plates are incubated for twenty-four hours at 37° C., and at the end of that time deep red colonies having a greenish tinge, if present, show the presence of *Bacillus coli communis*. Should no such fluorescent colonies develop, those which are moist, white, or pink, and about 0·5 to 1 cm. in diameter, are subcultured on tubes of nutrient gelatine, peptone water, neutral red broth, glucose formate broth, litmus milk, lead broth, and His's media, containing, respectively, glucose, lactose, dextrine, saccharose, and glycerine, and from the summary of the reactions of the organism in these media it is determined whether the organism is the *B. coli communis* or not.

### Particulars of Media Used.

(1) *Broth.*—Fresh meat extract to which is added 1 per cent. Witte's peptone, and 0·5 per cent. NaCl. rendered neutral to litmus, then 4 c.c. per litre of normal NaOH solution is added.

(2) *Glucose-formate Broth.* — Broth plus 0·4 per cent. sodium formate and 2 per cent. glucose, reaction as above.

(3) *Gelatine.* — Broth plus 12 per cent. gelatine (14 per cent. in summer), reaction as above.

(4) *Agar.*—Broth plus 2 per cent. agar powder, reaction as above.

(5) *Lead Broth.*—Broth plus 0·01 per cent. lead acetate, reaction as above.

(6) *Litmus Milk.*—Made neutral to and tinted with litmus.

(7) *His's Media.* — Serum 1 part, distilled water 3 parts; then 1 per cent. of sugar added.

(8) *Endos-agar* (modified). — Twenty grammes Lemco, 20 grammes peptone; 10 grammes NaCl, and 20 grammes agar to 1 litre of tapwater. Heat in a steam sterilizer for one hour, filter and make neutral to litmus; then add 10 c.c. of sterile 10 per cent. NaOH, 10 grammes lactose, 10 c.c. alcoholic fuchsin solution, and 25 c.c. of 20 per cent. sodium sulphite solution.

While employing these methods on the particular water supply under consideration, the endos media showed the growth of several translucent colonies, with slight pink central pigmentation and without fluorescence. Some of these when further examined gave the following reactions:—

| | 18 hours | 5 days |
|---|---|---|
| Glucose .. | Acid clot and gas .. | Acid clot and gas. |
| Lactose .. | Unchanged .. .. | Unchanged. |
| Mannite .. | Acid clot and gas .. | Acid clot and gas. |
| Saccharose .. | No change .. .. | No change. |
| Dulcite .. | Slight acidity .. | Acid clot and gas. |
| Litmus milk .. | Slight acidity; *no clot* | Slight acidity; no clot. |
| Peptone water | Uniform growth .. | Slight acidity. |
| Broth .. .. | Uniform turbidity .. | Uniform turbidity. |

and microscopically proved to be a freely motile coli-like bacillus, which did not stain by Gram's method, which was completely agglutinated in one hour in hanging drop by a thirty-fold dilution of the serum of an animal immunized by a local strain of the paratyphoid A bacillus; 1 c.c. of a twenty-four-hour-old broth culture proved fatal to a guinea-pig in less than twenty-four hours when inoculated intraperitoneally, the organism being recovered after death from the heart blood and spleen in pure culture.

These reactions, though not absolutely conforming to those accepted as indicative of the paratyphoid groups of organisms, were deemed sufficient to warrant the special examination of this source of supply for specific pollution.

The preliminary method employed to obtain the specific organism present in a quantity of fluid small enough to permit of being directly plated was that described by Dr. W. J. Wilson in the *British Medical Journal* of May 18, 1907.

This method consists in the evaporation of the specimen under reduced pressure after enrichment by the addition of about 15 c.c. of sterile broth to the litre of water.

The evaporation of the sample was stopped when the bulk was reduced to about 100 c.c. concentration, and was not pushed further owing to the large amount of solids present, as beyond this stage it was thought that the precipitation of the flocculent matter and the high concentration of the salts present might, as pointed out by Wilson, have an injurious effect on the growth of the organism.

The only modification introduced into the apparatus described by Wilson consisted in the lengthening of the tube inside the bottle which collects the distillate and the attachment of a valve at the end of this, the object being to prevent the regurgitation of the distillate back to the pump, when the pressure, owing to variations in the water supply, was reduced.

Although perhaps the isolation of a paratyphoid bacillus from this particular sample does not provide justification for claiming any particuiar merit for this method of the preliminary treatment of suspected waters, owing to the fact that the sample before concentration did not contain, as is usual with specifically-infected water supplies, a large number of other bacteria, at the same time it may here be said of it that on the occasions on which a positive result was obtained the organism, owing probably to a combination of raised temperature (37° C.), at which the evaporation was carried out, and to the preliminary enrichment by the addition of broth, was in such abundance as to make its isolation a matter of extreme simplicity, and in the other cases, about twelve in

number, in which this and other suspected waters were subsequently examined by this method with a negative result, one felt fully justified, owing to the exclusiveness of the test, in expressing the opinion that the specific organism was not present.

It was also of interest to note in this connection that the growth of the organism in fairly large numbers was not interfered with by the presence of the *B. coli communis* which was present in large numbers in the concentrate, and also that the differentiation of these two organisms, as is subsequently described, presented no difficulties.

Having reduced the bulk of the water under treatment to about 100 c.c., the residuum was treated as follows:—

About 1 c.c. was plated with a series of bile tubes (composition of bile media = ox bile, 90 c.c., peptone, 10 grammes, glycerine, 10 c.c.). A number of broth tubes were inoculated with similar amounts.

Ten-fold, hundred-fold, and thousand-fold dilutions of the residuum were made with distilled water and quantities of each dilution were planted on agar and endos media.

Various colonies from all these media were put through the preliminary tests for identification; of these, some isolated from the bile plates had the following morphology and staining reactions—namely, a slight freely motile bacillus, negative to Gram's stain, and having the appearances and fermentation reactions recorded below:—

| | |
|---|---|
| Agar slope .. .. .. | Moist, coli-like growth. |
| Broth .. .. .. | Uniform turbidity; good growth. |
| Glucose-formate broth .. | Good growth; no gas. |
| Litmus milk .. .. | Slight acidity; no clot. |
| Glucose (His's) .. .. | Acid clot and gas. |
| Mannite ,, .. .. | ,, ,, |
| Maltose .. .. .. | Slightly acid. |
| Galactose .. .. .. | Acid clot and gas. |
| Levulose .. .. .. | ,, ,, |
| Lactose .. .. .. | No change. |
| Saccharose .. .. | ,, |
| Dulcite .. .. .. | Slightly acid. |
| Glycerine .. .. .. | No change. |
| Dextrine .. .. .. | ,, |

This organism proved to be very virulent to guinea-pigs, 0·5 c.c. of a twenty-four-hour-old broth culture, causing death in less than twenty hours.

It was completely agglutinated by a thousand-fold dilution of the serum of an animal immunized against the paratyphoid A bacillus, and by a five-hundred-fold dilution of the serum of an animal which had been immunized against the typhoid bacillus (English origin).

On these results the organism was deemed to belong to the paratyphoid A group, and reported on accordingly.

There are certain discrepancies which exist in the above fermentation reactions when compared with the results obtained by other observers—namely, the action of this organism on mannite and dulcite. Birt, in the *Journal of the Royal Army Medical Corps* of August, 1907, when describing his observations on the fermentation reactions of paratyphoid A and B, does not mention the production of gas in these media as being a characteristic of either type of paratyphoid bacillus.

On the other hand the results of my own investigations of a large number of different organisms of this type, thirty-four in all, which had been in every case isolated directly from the blood of patients presenting a full clinical picture of enteric fever, [The majority of these organisms were kindly supplied to me by Major Statham, R.A.M.C., who had isolated them from the blood of patients under his charge, the remainder were isolated by myself], have shown that: (1) Of these thirty-four organisms, all except one fermented *mannite* with the production of gas in twenty-four hours at 37° C., in the remaining one gas was produced after forty-eight hours incubation; and (2) *dulcite* was fermented with the production of gas by twenty-seven, but in only one of these was this result produced within twenty-four hours; in the case of the other twenty-six organisms the gas-production was delayed for intervals, varying from forty-eight hours to five days. The remaining seven produced no change, or only a slight acidity in this medium. It will be seen by a reference to the foregoing table that the organism in question possessed this property in both mannite and dulcite media, and similarly gas production was delayed in the dulcite medium, while conforming to the accepted standards of fermentations in other respects.

The results of the routine bacteriological examination of this water for the five weeks during which it was under suspicion are given below.

They show the absence of gross contamination of any sort, and compare very favourably with other sources of supply from the same locality about which there was never any suspicion of specific contamination.

*First Week.*—Seven organisms per cubic centimetre growing at 37° C., *Bacillus coli communis* not found in 10 c.c. Streptococci not found in 10 c.c.

*Second Week.*—Three organisms per cubic centimetre, growing at 37° C., *B. coli communis* not found in 10 c.c. Streptococci not found in 10 c.c.

*Third Week.*—Six organisms per cubic centimetre, growing at 37° C., *B. coli communis* present in 1 c.c. Streptococci not found in 10 c.c.

*Fourth Week.*—Five organisms per cubic centimetre, growing at 37° C., *B. coli communis* present in 3 c.c.

*Fifth Week.*—Four organisms per cubic centimetre, growing at 37° C., *B. coli communis* present in 3 c.c.

The following are some of the points with regard to the chemical analysis of this sample which are shown in the report of the Government Analyst for the Transvaal (Dr. J. McGrae), frequent examinations being made by him during the time the water was under suspicion:—

(1) The turbid appearance of the water as compared with other waters drawn from bore-holes in the same district, due partly to the oxidation of the iron in solution, on exposure, and consequent precipitation of hydrated ferric oxide, and also to some extent to clay held in suspension.

(2) The fairly constant amount of chlorine, sufficiently so to indicate that there has been no gross contamination from animal sources.

(3) The excessive amount of saline ammonia, albuminoid ammonia, and oxygen absorbed, the last of these being to some extent discounted owing to the presence of dissolved iron.

(4) The maximum amount of saline ammonia found

in this water was 0·0144 parts per 100,000, and the minimum 0·0036. The albuminoid ammonia varied from 0·0076 to 0·0024, while the average amounts of saline and albuminoid ammonias in samples from bore-holes in the same district is placed at 0·0001 and 0·0002 respectively.

(5) The hardness in the samples from this and other bore-holes in the district would give reason to expect approximately the same quality of water from all, whereas the quality of this water from a chemical standpoint was distinctly inferior to that of the water drawn from other bore-holes in the vicinity, and on the same geological formation.

(6) The presence of a considerable quantity of algæ growth and its decay in this source would to a great extent account for the relatively high amount of nitrogen present.

The bore-hole from which this particular supply was derived was one of a series which were scattered over a large area.

A shaft 15 ft. in depth with lined sides contained the necessary parts of the pumping machinery.

An 18-inch bore-hole, steel-cased for 55 ft., extended from the bottom of this shaft for a depth of 141 ft.

A smaller bore-hole extended from this for a further 42 ft., making the total depth from the surface 183 ft.

The greater part of this bore-hole was sunk through dolomite. There was apparently no impermeable stratum between the surface and the point from which the water was drawn. From the fact, as reported by those in charge, that the supply was unaffected by rainfall, the collecting area was judged to be a large one.

The water-bearing dolomite was reported to be covered by a loam varying in thickness from 20 ft. to 60 ft.; it would therefore seem that the filtration of water percolating from the surface should be efficient, and that the contingency of surface contamination might be disregarded.

There was, however, one condition present which might be looked upon as doubtful, namely, the splashing from the pump at each return of the piston.

The return water from this source had apparently no other outlet than to percolate back in the direction of the bore-hole. As there was necessarily a certain amount of traffic in connection with the pumping machinery at this position, and at or about the same time that the specific organism was isolated some repairs were being carried out in connection with the pump, contamination through this source would seem a possibility.

The viability of this organism under the conditions obtaining in this particular supply can only be estimated by the results of subsequent examinations, which all proved negative, but which, while pointing to the probability of its absence, cannot be taken as conclusive proof of such.

With the object of gaining some idea of its life in water at ordinary room temperatures (about 16° to 18° C.) the following experiment was carried out: A portion of a twenty-four-hour old growth of this organism on agar slope was mixed in a Winchester quart bottle full of ordinary tap water and kept at room temperature for exactly two months, about one-third of the amount of water in the bottle being removed from time to time and replaced by fresh water. At the end of this time, employing the same technique as employed before, namely, enrichment and concentration, the organism was easily recovered from the specimen.

The source of this infection must remain a matter of conjecture; fæcal or sewage contamination, as judged by the physical aspect of the source of supply and the results obtained both chemically and bacteriologically in the search for definite evidence of such pollution, as detailed above, would seem to be impossible, and the more likely source would seem to be a urinary contamination. With this idea in view, the bloods of most, but unfortunately not all, of the workers at this bore-hole were tested for agglutination powers with this and several other strains of the paratyphoid and typhoid organism, but with negative results.

The urines of these men were also examined with the object of isolating the organism if present, but also with negative results.

A word may be said here on the convenience and suitability of His's serum water media, the composition of which, as used in these laboratories, is detailed above in the routine examination of waters for the presence of *B. coli*, and, in special cases, in the identification of special organisms of the typhoid or paratyphoid groups.

The occurrence of acid and fermentation is well shown by the alteration in colour and by the coagulation of the medium, and the presence of gas which is trapped in the medium coagulated by fermentation is easily recognized. In this there is a marked advantage in the first place over media which remain fluid, and in which the occurrence of gas, unless in great abundance or unless a trap tube be used, is frequently missed, or is difficult to differentiate from air-bubbles. It has then the distinct advantage of being able to dispense with the use of a trap tube.

Over solid culture media, such, for example, as the sugar agars, there is the great advantage of obviating preliminary liquefaction, thus reducing the probability of discrepancies in results.

The results obtained in the examination and identification of a large number of organisms isolated from the blood of patients for diagnostic purposes have led me to the conclusion that this form of medium fulfils all the necessary requirements, and is infinitely superior, in the ease and rapidity with which it can be used, to any other form of medium used in this connection.

My results, both in the routine examination of water supplies and in connection with the identification of organisms for clinical diagnosis, have been constant throughout. In no case did a failure result in the identification and accurate classification of the organisms under examination as controlled by their reactions on more widely recognized media.

The use of this medium as a means of identification of the *Bacillus coli communis* was also attended with very satisfactory results, and can be recommended, as previously described in the routine examination of water, as a method presenting few difficulties and giving quite reliable results when used in conjunction with endos and glucose-formate broth media.

Our present state of knowledge with regard to the characteristics and varieties of the paratyphoid bacillus is so imperfect that there is much room for wide differences of opinion on the subject of what constitutes its identification and classification.

There are, however, three salient points which, taken together with its morphology and staining reactions, would seem to place the organism here in question beyond doubt in the paratyphoid group.

These are its characteristic fermentation reactions, its action on litmus milk, and its agglutination reactions with specific sera.

The danger to the public health of such infected water when distributed even for a few days only, as was here the case, and in a daily supply of about three million gallons, much the greater part of which supply was derived from other presumably uninfected sources, can only be estimated by its effect on the incidence of enteric fevers within the area of distribution during that time.

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## FILARIA LOA.

By George C. Low, M.A., M.D.

It is now generally accepted by filariologists that Sir Patrick Manson's *Filaria diurna* embryos are really the young forms of *F. loa*. Though this is so, one still sees it erroneously stated in text-books and other places that these diurnal embryos are similar or identical in measurements to those produced by the *F. bancrofti*. I pointed out that this was not the case, while taking part in a discussion on a paper read by Sir Patrick Manson—"On the Nature and Origin of Calabar Swellings"—before the Society of Tropical Medicine and Hygiene, on February 18, 1910. [1]

Recently having had the opportunity of again verifying the measurements given by me there, I now return to the subject, its importance meriting, I think, a thorough ventilation. Much of the confusion that has arisen between the two embryos has undoubtedly been caused by the common error of calling any embryo seen in the blood by day a *F. diurna* and so plenty of real *F. bancrofti* have been mistaken. Recently, in looking over some slides sent me from West Africa, and labelled *F. diurna*, I had not the slightest difficulty in satisfying myself that the worms present were examples of *F. bancrofti*, examples which for some reason or other had remained in the peripheral blood by day. This is common, of course, and in Fiji and in some of the other South Sea Islands a diurnal occurrence seems to be the usual thing.

If, however, one takes a case with genuine *F. diurna* embryos in the blood then there is not the slightest difficulty—especially if one has had a little practice—of saying definitely that the worms are distinctly different from the embryos of *F. bancrofti*. Sir Patrick Manson first pointed out the peculiarity of the curves or shapes in which the embryos of the two species die when dried on ordinary slides, and this feature is a distinctly marked one, and one which is of undoubted value in differentiation. It may, in fact, settle the question at once.

The genuine *F. diurna* embryos (microfilaria loa) measure from ·210 to ·280 mm. in length (fresh living specimens) (average ·240 mm.), by ·0070 to ·0075 mm. in breadth, the V spot being situated ·060 to ·073 mm. from the head, the break (seen in stained specimens) being ·042 mm. from the same point. Embryos of *F. bancrofti* on the other hand measure from ·280 to ·320 mm. in length (a good average measurement being ·310 to ·317 mm. by ·0075 to ·0084 mm. in breadth, the V spot being situated ·090 mm. from the head, the break in the cells ·050 mm. (or over) from the same point.

Clearly, therefore, the embryos of *F. bancrofti* are longer and slightly broader than those of *F. diurna*, though one must admit that as regards other anatomical points there is a striking similarity between the two. Different methods of staining might help sometimes in differentiating. Once staining a batch of films containing *F. diurna* with Delafield's hæmatoxylin for ten minutes in the cold the central nuclear column failed to stain, but the V and tail spot came out splendidly, whereas the same stain used for the same time failed to produce a similar result with the embryos of *bancrofti*, no signs of these spots being visible at all. I have not subsequently confirmed this, however, and possibly with other batches of slides from different cases the same might not hold good.

If, on the other hand, these diurnal embryos found in the peripheral blood of people coming from Nigeria and adjoining parts of the West Coast of Africa are really the young of the adult *F. loa*, then mature embryos taken directly from the uterus of loa females should completely correspond with them.

This is found to be the case. Some years ago Dr. Currie, of Lagos, sent me specimens of embryos squeezed out of the uterus of a mature female *F. loa* adult, and I measured and studied these in detail. Though a slight discrepancy may have crept in owing to shrinkage from the staining (the specimens were stained), yet the results may be looked upon as approximately correct.

Forty in all were measured, the average length coming out at ·245 mm., with a breadth of ·0075 mm. Mature eggs—of which there were also samples in the specimens—measuring ·0425 mm. long by ·0330 mm. broad. The embryos, as expressed from the uterus of the adult *F. loa*, then are sheathed, have sharp-pointed tails, exhibit a break in the continuity of the cells, show the usual nuclear column of cells in the middle of the body and have the measurements given above, measurements which correspond exactly in every detail with those of the so-called *F. diurna*.

In many of my specimens a line seemed to run from the cephalic end of the sheath to the extremity of the head, but whether this is an artefact or not I have not been able to absolutely determine.

Braun, in the 1903 edition of his book, "The Animal Parasites of Man," [2] gives the following measurements for the larval forms of *F. loa*: From ·253 to ·262 mm. in length by ·0047 mm. to ·0050 mm. in breadth. He does not state where his material came from nor who made the measurements, but though the length is correct manifestly the breadth is too small, being on a par with that of *F. perstans* or *F. demarquayi*. If this were correct then the *F. loa* embryos could not

be the same as those of *F. diurna*, but my measurements just given show that this is not so, the breadth of the two being the same.

TABLE SHOWING DIFFERENCES BETWEEN THE EMBRYOS OF *Filaria bancrofti* AND *Filaria diurna*, ALSO POINTS OF SIMILARITY BETWEEN THE LATTER AND THE EMBRYOS OF *Filaria loa*.

| — | *Filaria bancrofti* embryos | *Filaria diurna* embryos | *Filaria loa* embryos |
|---|---|---|---|
| Average length | ·317 mm. .. | ·240 mm. .. | ·245 mm. |
| Average breadth | ·0084-·0075mm. | ·0075-·0070mm. | ·0075 mm. |
| Break in cells from head | ·050 mm. .. | ·042 mm. .. | — |
| V spot from head | ·090 mm. .. | ·060 mm. .. | — |
| Eggs (average) | ·050 × ·033mm. | — | ·042 × ·033mm. |
| Character of curves in dried specimens on slides | Spiral coils .. | In wavy lines | — |
| Periodicity .. | In blood at night (or in equal numbers in blood by day and night—Fiji, &c.) | In blood by day | — |
| Periodicity when habits of sleeping and waking changed | Inverted .. | No change .. | — |

*Periodicity.* — Another distinction between the embryos, which we must now call embryo or larval *F. loa* (microfilaria loa), and the embryos of *F. bancrofti* may, I think, be found in a study of their different periodicities. This question of periodicity, as all know, is sometimes very marked (nocturnal periodicity) in the case of *F. bancrofti*, but in other cases (Fiji, Samoa, &c.) it seems to vary greatly, numbers often occurring in the peripheral blood in equal force by day as well as by night. In all the genuine cases of loa infections with embryos in the peripheral blood that I have studied the diurnal periodicity has always been very constant, and in one attempt to invert the periodicity by inverting the habits of the patient—an experiment carefully carried out by myself on one of Sir Patrick Manson's cases at the Seamen's Hospital some years ago—complete failure resulted, the embryos still appearing in the blood by day, even though the patient slept. As far as I am aware no one has confirmed or refuted this observation—I have not myself, as suitable opportunities have been wanting—but I quite believe the same result would happen again, as the experiment I mention was carried out with the greatest care and accuracy. However, apart from the interest of the observation it is not necessary, as the measurements of the *loa* embryos clearly show that they are different from *bancrofti* ones.

*Further Points in the Life-history of F. loa.*—Though we may say that we have advanced in our knowledge of the life-history of *F. loa* to this extent—namely, to be able to say that the old *F. diurna* embryos are really the young of the *F. loa*, yet in other respects progress is completely stationary.

We do not, for example, know the intermediate host, nor why, in some cases, though adult worms are wandering about the subcutaneous tissues, no embryos are present in the blood; nor, again, though embryos are present in the blood why there are no signs of adults and so on. Only carefully-kept records of cases over long periods of time will help us in determining many of these points.

THE INTERMEDIATE HOST OF F. LOA.—Analogy leads one to suppose that an intermediate host must be necessary for the embryos of the *F. loa* to develop in, just as is the case with the embryos of *F. bancrofti* and with the embryos of the *F. immitis* of the dog. It is difficult certainly to see how the embryos could escape from the peripheral blood without the aid of some suctorial insect to extract them, and in trying to come to any definite conclusion as to what that insect might be many things have to be taken into account.

Looking for a moment at the two filariæ just mentioned we find that the embryos of *F. bancrofti* develop in the thoracic muscles of *Culex fatigans* or of *Anophelines*, the embryos of *F. immitis* in the malpighian tubes of *Anophelines* or *Culex*. Both these genera of mosquitoes are chiefly nocturnal in their habits, and feed by night, and the periodicity of the embryos of *bancrofti* was supposed by Manson to be an adaptation to this characteristic of the host. That it is not absolutely so is at once seen by the fact that the embryos of the *F. immitis* occur in the blood of the dog by day as well as by night, and also by the fact of the Fijian species of *bancrofti* doing the same.

Still, if a mosquito or other biting insect is to act as a host for the embryos of *F. loa*, and if the contention that their diurnal periodicity is always as marked as has just been described is correct, then the act of suction to be of any use must take place by day. This in no way invalidates some genus or species of mosquito as functioning of course, because many of these bite readily by day—the genus *Stegomyia* for example; but if a mosquito is the intermediate host then it will most probably be one with a more or less limited geographical range corresponding to that of the parasite, though even this does not necessarily follow. Manson has suggested that the "mangrove fly" might act. I have enquired from men coming from Southern Nigeria about this fly and find that it is a local name loosely applied to several biting flies, chiefly of the genus *Tabanus*, and such being the case I do not think in all probability that it has anything to do with the dissemination of the filaria in question.

It may be that an insect with a geographical distribution corresponding to the filaria is responsible, and in working at the subject that would be the first point to determine. Failing such a discovery all the different blood-sucking insects will have to be studied in detail—*Tabanidæ* and allied genera, *Stomoxys*, *Glossina*, and day-feeding mosquitoes; while the probability of ticks, *Ornithodorus moubata* or otherwise, playing a part must not be overlooked.

THE OCCURRENCE OF ADULTS WITHOUT EMBRYOS IN BLOOD.—It is not always easy to explain why, when a patient has had adult worms in the eye or elsewhere, that one may often search the blood in vain for embryos. The adults that were present might only have been males, and so no breeding might have been

going on, or again both sexes might have been present but immature.

Against this, however, is the fact that in some instances though mature adults have been extracted yet no embryos have been found in the blood, and further, in one case at least, who frequently got Calabar swellings no embryos appeared in his blood at the time or four years later. The converse of course—embryos in blood and no signs of adults—is nothing, because the latter may be in some of the deeper tissues, and at any time may come nearer the surface and so produce symptoms. Still I know of one case three and a half years away from the endemic area with plenty of embryos in his blood, and yet he has never exhibited the slightest signs of an adult. Centrifuging the blood has been recommended to detect scanty adults—the method is useful, but repeated examinations by the thick film method of Manson will reveal their presence sooner or later if they are present at all.

Diseases caused by F. loa.—Living as it does in the subcutaneous and connective tissues, the *F. loa* is not likely to produce anything very gross in the way of pathological lesions, and this, so far as we know, is so.

By its death one would have supposed, provided organisms were present, that like the *F. bancrofti* it might have given rise to abscess formation, but this has, as far as I am aware, never been recorded. In its movements about—and these are often very active—it may give rise to a series of minor discomforts such as pricking, itching, or creeping sensations, and when it crosses the conjunctiva to irritation accompanied by lachrymation. It is now generally admitted that what were first described and named Calabar swellings by Dr. Thompstone, of Southern Nigeria, are lesions due to the *F. loa*. These swellings are common among negroes as well as whites in Calabar and the adjoining territories, in fact in areas where *F. loa* is common. Dr. Thompstone describes them as follows: "The swellings are about the size of half a goose's egg, they are painless though somewhat hot, both objectively and subjectively, they do not pit on pressure and they usually disappear in three days."

The cases I have seen correspond closely with this description. Such lesions have not been noticed in other parts of the world, and the fact of their geographical range being so similar to that of *F. loa* is very suggestive of a causal connection. Some have been led to the belief, however, that there is no connection between the filaria and these swellings because of the fact that in many cases no embryos have been demonstrable in the peripheral blood. Sir Patrick Manson's experiment [3] was vitiated, of course, by the patient having embryos in his peripheral blood, and to make it of value a similarly-conducted one would have to be positive in a case where nothing could be detected in the peripheral blood. Personally, my opinion is that these swellings are due in some way or other to the worms, but how they produce them is not clear, the presence of otherwise unexplainable eosinophilia in many of these cases is certainly suggestive (*vide* later).

Recently I have seen some other symptoms which I believe were due to this filaria. I do not know if these have been specially noted before or not. The first was a complete swelling of the forearm which became generally hard and boardlike; the second a condition resembling pruritus of the arm; and the third a severe pain in the eye with photophobia. (Specialists on the eye could detect nothing wrong with the organ; eosinophilia was present in the blood—*vide* later).

*The Diagnosis of F. loa.*—In coming to the diagnosis that a case is one of *F. loa* infection, four points should be attended to:—

(1) The actual presence of the worm. Has this been seen or has one been extracted? If so, of course the diagnosis is complete.

(2) The presence of diurnal embryos in the peripheral blood exhibiting the measurements and characteristics described above.

(3) The actual presence or history of Calabar swellings.

(4) Eosinophilia with no explainable cause.

In analysing cases one does find all these four characteristics present from time to time (Sir Patrick Manson's case, already mentioned, on which I conducted the periodicity investigations, was one of these), but on the other hand it is equally, or even more frequent, to find one, two, or even three of these points absent. A short synopsis of a few cases will explain this more clearly perhaps.

### Case I.—Summary of Case.

*Calabar Swellings. No Proof of F. loa. No Diurnal Microfilaria Present. Eosinophilia not tested.*—This was an interesting case, and the history is so representative of Calabar swellings that it may be given in detail. Patient had served fifteen years in Southern Nigeria with the usual home leave. Went to live in Calabar as headquarters in 1900, apart from malaria no other illnesses. First noticed symptoms of Calabar swellings, June, 1904. At that time had swellings of both arms, both hands, and right eye, his doctor thinking that latter was due to the bite of some insect. The swelling of arms affected the forearms chiefly, and was more or less general. Since that time up to 1906, at home and abroad, has suffered from small localized swellings on extensor aspect of lower part of forearms. Size about that of a pigeon's egg. On November 22, 1905, I saw the patient while suffering from one of these on the extensor aspect of right forearm. This swelling resembled in appearance a large ganglion; it was about the size of a bantam's egg, was white in colour, did not feel hot, did not pit on pressure, was quite painless, and apart from the stiffness to the arm it produced did not give rise to any great inconvenience. Next day the swelling was much less, and on the third day it had practically disappeared. The day blood examined at that time showed no embryos, nor did the blood examined four years and a half afterwards.

### Case II.—Summary of Case.

*Calabar swellings, no proof of F. loa, no diurnal microfilaria present. Eosinophilia present, marked.* Another typical case of Calabar swellings. Patient's own description of one of these was as follows: "The part affected becomes stiff, and there is a feeling as

if one could take one's arm up and squeeze something out of it; there is also a tingling, somewhat itchy feeling, like the sting of a jelly-fish. They last from a few days to a week, and their size is that of a small hen's egg." No *F. loa* had ever been seen.

Blood count :—

| | |
|---|---|
| R. .. .. .. | 5,000,000 |
| W. .. .. .. | 6,800 |
| Hb. .. .. .. | 100 per cent. |

Differential :—

| | | |
|---|---|---|
| Polymorphonuclear .. | 59 per cent. | |
| Large mononuclear .. | 5 ,, | |
| Lymphocytes .. .. | 26 ,, | 500 counted. |
| Eosinophile .. .. | 9 ,, | |
| Transitional .. .. | 1 ,, | |
| Mast cells .. .. | 0 ,, | |
| | 100 | |

Examinations for filaria on four different occasions, three large films being examined at each time, always negative.

### Case III.—Summary of Case.

*Once a swelling of arm. ? Calabar swelling. Great pain in eyeball and photophobia; never any sign of F. loa; no diurnal microfilaria in blood. Eosinophilia for which no reason could be assigned present.* This case has already been referred to under the section "Diseases caused by *F. loa*." As was noted there, eye specialists could detect nothing in the eye to account for the symptoms. The patient came from an endemic area, and, personally, I believe, the symptoms had to do with the filaria.

Blood examination :—

| | |
|---|---|
| R. .. .. .. | 4,500,000 |
| W. .. .. .. | 4,200 |
| Hb. .. .. .. | 85 per cent. |

Differential :—

| | | |
|---|---|---|
| Polymorphonuclear .. | 55·6 per cent. | |
| Large mononuclear .. | 2 ,, | |
| Lymphocytes .. .. | 29·2 ,, | 500 counted. |
| Eosinophile .. .. | 10·4 ,, | |
| Transitional .. .. | 2·2 ,, | |
| Mast cells .. .. | ·6 ,, | |
| | 100·0 | |

The peripheral blood was examined on five different occasions—over three months—the first time the night blood being done as well; in every instance three large films (eighteen in all) being carefully examined; no filariæ were ever seen.

A second estimation of the eosinophiles gave 18·6 per cent.; a third 14 per cent. There were no ova of any kind in the fæces to account for this, nor any other of the usually recognized causes of this condition.

### Case IV.—Summary of Case.

*F. loa seen twice in eye not extracted. Never Calabar swellings. No diurnal microfilaria in blood. Eosinophilia present* This would seem to have been a comparatively recent case of infection, the first symptom of the worm appearing in April of this year (1910).

Blood examination : –

| | |
|---|---|
| R. .. .. .. | 5,050,000 |
| W. .. .. .. | 7,600 |
| Hb. .. .. .. | 95 per cent |

Differential :—

| | | |
|---|---|---|
| Polymorphonuclear .. | 67·0 per cent. | |
| Large mononuclear .. | 2·4 ,, | |
| Lymphocytes .. .. | 20·2 ,, | 500 counted. |
| Eosinophile .. .. | 9·0 ,, | |
| Transitional .. .. | 1·2 ,, | |
| Mast cells .. .. | ·2 ,, | |
| | 100·0 ,, | |

Here the peripheral blood was examined on four different occasions, seventeen thick films in all, but with the exception of one embryo of *F. perstans*, which means, of course, a double infection, no filaria were seen.

Here again there were no signs of any ova of intestinal parasites in the fæces.

### Case V.—Summary of Case.

*Never any sign of a F. loa adult. Never Calabar swellings. Peripheral blood teeming with diurnal embryos. Eosinophilia not tested.*

This is a somewhat remarkable case. The subject had been over three and a half years away from the endemic area (all that time living in this country). He had never presented any signs of filarial infection. I simply examined his blood on the off-chance of something, as he had been in Nigeria, and was rewarded by finding the embryos. His subsequent history should be interesting.

These cases show how difficult it is to get a connected chain of evidence right through of the different relationships which the symptoms mentioned bear to each other. Prolonged investigations over long periods of time in selected cases will do much to clear up this obscurity, however, and this I hope to be able to do in some of the cases described above.

### REFERENCES.

[1] *Transactions of the Society of Tropical Medicine and Hygiene*, March, 1910, vol. iii., No. 5, pp. 261.

[2] "Die thierischen Parasiten des Menschen," von Dr. Max Braun. Wurzburg, 1903.

[3] *Transactions of the Society of Tropical Medicine and Hygiene*, March, 1910, vol. iii., No. 5.

## "Bulletin of Entomological Research," October, 1910, (vol. I, part 3, pp. 161-232).

The last issue of the *Bulletin of Entomological Research* contains the following original articles: (1) West African Hemiptera injurious to cocoa, by G. C. Dudgeon. (2) On West African Trypetidæ (fruit flies), by W. M. Graham. (3) Remarks on coccidæ from Uganda, by E. E. Green. (4) Notes on movements of *Glossina morsitans* in the Lundazi district, North-Eastern Rhodesia, by P. E. Hall. (5) Some further observations on the scale insects of the Uganda Protectorate, by R. Newstead. (6) Notes on the habits of *G. morsitans* in Nyasaland and the adjoining territories, by Sir Alfred Sharpe. (7) Miscellaneous articles on "The Investigation into the Origin of Sleeping Sickness Infection in the Luangwa Valley," &c.

## "Norsk Magazine for Laegevidenskaben," October, 1910.

### Leprosy Bacilli in Fæces.

Boeck has met with three cases of leprosy in which the leprosy bacillus was recovered from the fæces. The cases were far advanced in the disease. The possibility of contracting leprosy from fertilizing the land with human fæces is referred to, both by inoculation of bare feet and by way of uncooked vegetables.

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THE JOURNAL OF

# Tropical Medicine and Hygiene

JANUARY 2, 1911.


## IS PONOS KALA-AZAR? PROFESSOR GALLÈ'S DISCOVERY?

PROFESSOR RONALD ROSS has received a note intimating the fact that Professor Gallé, of Rome, has found the Leishman-Donovan body in a case of "ponos." The patient dwells in the island of Spezzia off the Corinthian Coast of Greece. The discovery is of scientific and practical importance, as it tends to confirm a belief which has prevailed for some considerable time, that the disease called "ponos" in Spezzia and the adjacent island of Hydra is due to infection by the Leishman-Donovan body. A good deal has been written concerning this disease in the Mediterranean littoral. In his book on "Tropical Diseases" (Fourth Edition, 1907), Sir Patrick Manson states that "the presence of a pronounced leucopenia suggests a protozoal germ similar to that of kala-azar." Nicolle found in Tunis a disease resembling "ponos," and in the blood of the liver and spleen the Leishman-Donovan bodies were met with. At the British Medical Association, July, 1909 (JOURNAL OF TROPICAL MEDICINE AND HYGIENE, August 16, 1909; *British Medical Journal*, September 16, 1909, p. 781), a paper was contributed by Dr. G. A. Williamson, of Cyprus, as to the identity of ponos and kala-azar. Dr. Williamson, on a visit to Spezzia and Hydra, with a view of clearing up the matter, had the misfortune to encounter no cases of the nature of ponos; yet he is strongly of the opinion that ponos and kala-azar are identical, and his well-reasoned argument, although short of complete demonstration, seemed convincing. Dr. W. H. Graham Aspland, in a note to the *British Medical Journal* of January 15, 1910, states that he had seen many cases of kala-azar in children in North China, but not in adults, and mentions the fact that Dr. Lillie Saville, of Tientsin, China, found Leishman-Donovan bodies in the peripheral circulation in very late stages of the disease.

Many causes have been assigned as the cause of ponos. Malaria has been discounted, and never more conclusively than by the fact that in Spezzia and Hydra, where ponos prevails, malaria is unknown. Dr. Aspland inclines to the belief that the disease is due to inherited syphilis. It is now well known that the Leishman bodies have been met with in several countries adjacent to the eastern end of the Mediterranean littoral—Tunis, Algiers, Egypt and Arabia, and in Oriental sores in patients in these countries and in Cyprus; there seems every possibility therefore of Leishmaniasis being present in the Greek islands. This point Professor Gallé has now succeeded in demonstrating, and we congratulate him on this important addition to our knowledge. Leishmaniasis includes now kala-azar, ponos, oriental sore, and perhaps cancrum oris in its category, and demonstrates once more the march of scientific investigation in the direction of annihilating apparently diverse diseases masquerading under local names, and bringing them into line in their proper place.

The prevalence of cancrum oris in association with Leishmaniasis is a factor of wide interest and extends beyond the Tropics, for if the cancrum oris of Leishmaniasis is identical with that met with in temperate climates, it is time that the pathology and etiology of cancrum oris in northern Europe were tested from these points of view. In northern Europe cancrum oris is met with in young children only, and in this it agrees with the age at which Leishmaniasis manifests its presence; but in tropical countries cancrum oris is not confined to children, for, as Mr. J. Cantlie related at the British Medical Association in July, 1909, he had seen the disease amongst Indian artillery soldiers stationed in Hong-Kong, and not only sporadically for as many as five cases were under treatment at one time.

"East is East and West is West" in regard to many things, but the distinction is not recognized by parasites, for so many so-called "tropical" parasites are recognized in colder climes that ailments hitherto obscure in their etiology are now shown to have existed undetected in the very centres of scientific research.

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# Abstracts.

## THE DISCUSSION ON THE DISTRIBUTION AND PREVALENCE OF YELLOW FEVER IN WEST AFRICA AT THE SOCIETY OF TROPICAL MEDICINE AND HYGIENE.

Dr. TULLOCH (Trinidad), in opening this important discussion, said: I had not the opportunity of hearing Sir Rubert Boyce's paper, although I have since seen it, nor had I any inkling of the new view therein laid before this Society before I left Trinidad. There are, of course, many men in London and in the West Indies more competent to deal with this paper than I am, but it so happens that there is no one available with as much experience of yellow fever and bilious remittent fever as I have. Further, and what has weighed very considerably with me, is the feeling that some one should appear on behalf of the West India Services to express what I feel sure must be the opinion of the majority of them—viz., that the new and somewhat alarming conclusion at which Sir R. Boyce has arrived should not be accepted without very careful and thorough consideration. I know nothing of West Africa, but I take it for granted that Sir Rubert must follow the view he has expressed in his paper to its logical conclusion, and that he holds that yellow fever is as much endemic in the West Indies as it is West Africa. Our so-called bilious remittent fever appears to be practically the same as it is in Africa, and if the one is mild yellow fever, so I take it must the other be. Of both of these diseases I can claim to know something. I have never to my knowledge had yellow fever, but I *have* had twice what I and others considered to be pretty severe bilious remittent fever. I saw very little of the 1893-1894 epidemic of yellow fever, as I was then stationed in Tobago, but I was through the 1907-1908 outbreak, and saw a good many cases.

Let me first describe what we in Trinidad and Tobago call bilious remittent fever. We consider it to be a form of malaria, in which the principal manifestations are gastric and hepatic. Its onset is almost always preceded by some marked reduction of one's resisting power, the result of temporary want of food, undue exposure or over-exertion, or chill, or a combination of these occurring in an individual who has been exposed to malarial infection. You get initial chill or slight ague, a temperature, a coincident pulse ratio, headache, backache, general bone-ache, flushing of the face, injected conjunctivæ, and furred tongue, with constipation. Later, you have some jaundice confined to the sclerotics. The urine is very high coloured and bilious. There is slight enlargement and tenderness of the spleen, and there is epigastric distress and tenderness. But the one symptom which overshadows all others is the vomiting, first of the stomach contents, then of bilious fluid of the most intensely bitter description, and finally nothing at all. This is purely mechanical. There is no hæmorrhagic tendency in the bilious remittent fever with which I am familiar. In fatal cases I have repeatedly felt that an important factor in determining the issue was the exhaustion caused by this terrible vomiting. The one drug that has any effect in the treatment of our bilious remittent is quinine. After relieving the congested liver by calomel you have to get quinine into the system—not, of course, into the stomach, but by intra-muscular, or in children by rectal, injection. Now compare this disorder with yellow fever. One attack of yellow fever confers immunity for life. I have had bilious remittent twice, at least. A lady patient of mine, who had recovered from yellow fever in Barbados, in 1881, very nearly died from our bilious remittent in 1888.

Yellow fever is epidemic, bilious remittent is endemic. Yellow fever is characterized by a tendency to hæmorrhage, and the urine in pronounced cases is always albuminous. In bilious remittent I have never seen hæmorrhage, and albuminous urine is with us a rarity, and probably, a coincidence. The vomiting of bilious remittent is its most distressing symptom. In yellow fever the vomiting is never anything like so severe, and the pathognomonic black vomit is a mere syphoning out of the stomach contents. In yellow fever quinine has no appreciable effect. In bilious remittent it is a specific. But during our last epidemic we did see many cases of mild yellow fever among the negro population, and we actually recognized a fair proportion of them. They had all the appearance of ordinary seasonal malarial fever, except that a little extra care in examination showed a slight jaundice and albuminous urine, the latter often quite well marked. Their existence explained the erratic distribution of admitted cases of yellow fever, but they bore a very slight resemblance to the severe form of bilious remittent, with which I am familiar.

Sir Rubert admits that in Barbados, which is fortunate enough to have no malaria, yellow fever is introduced from without. Does he hold that Trinidad, with as large and as varied a maritime trade, and with its immediate proximity to the Spanish Main, produces or is able to produce its own epidemic? If so, how does he explain the non-occurrence of yellow fever in Tobago, with, I believe, a greater prevalence proportionately of bilious remittent, but with an insignificant shipping trade? Had Sir Rubert merely stated that well-marked cases of yellow fever had been returned as bilious remittent, we would be with him to a man. We have, nearly all of us, done it, but circumstances have recently occurred which will render its repetition improbable. Even when we were certifying death as being due to "malignant or pernicious remittent fever of a hæmorrhagic type," we knew the difference between the two diseases, and we are quite alive to the fact that an epidemic disease, characterized by jaundice, erratic pulse ratio, albuminous and scanty urine, hæmorrhage, and a high mortality, was not the same as an endemic malarial fever, whose symptoms are distressing, vomiting, slight yellowing of the sclerotics, splenic tenderness, deeply bile-stained non-albuminous urine, a tendency to recovery, and curability by quinine. I have not approached this matter from the scientific side. I have not the data with me. I leave that to the scientists present here to-night. Nor, as a matter of fact, has Sir Rubert himself. How can he?

This brings me to my last word. It is hard, gentlemen, to disprove a theory which is itself incapable of proof. In the absence of any knowledge of the organism which causes yellow fever, it is impossible for Sir Rubert Boyce to demonstrate the accuracy of his new view.

Dr. CHARLES R. CHICHESTER (West Africa) said: When it is considered that I have been nearly fifteen years on the Coast, and have fought an epidemic of yellow fever, perhaps some little importance will be attached to my opinion. If Sir Rubert's contention that yellow fever is always with us is correct, then far more energetic measures for exterminating stegomyia must be adopted in the future than have been proposed as a result of his visit to the Coast. Only those who have had to deal with such questions know the difficulties which confront the sanitary officer in his attempts to rid a place thickly inhabited by a mixed population. Separation of whites from blacks is the first and most important measure, but the mere finding of larvæ inside the premises should be punishable. As I understood from Sir Rubert, yellow fever is always with us, is kept up by being transmitted from native to native, causing a disease not as yet diagnosed, and breaks out in severe epidemic form among the whites from time to time, and often at very considerable intervals. We always, however, have it among the Europeans in isolated, undiagnosed, more or less severe cases. This is a startling proposition. How comes it that, with a fairly large, non-immune, European population, living (as in Lagos, Bathurst, Sierra Leone, and elsewhere) among and surrounded by natives, epidemics are not more numerous? An isolated case of a strange disease here and there may not attract much attention. But if a second presents itself soon after, having much the same strange symptoms, doubt and anxiety are at once aroused. Personally, whenever I have had a serious case, I have always called in other opinion, where it was possible to obtain it, and it is always possible in coast towns of any size. I fancy that this is always done, and it does not seem likely to me that a second case thus attended will die without suspicion having been aroused, supposing it to be yellow fever. Sir Rubert thinks that there is a "vast amount of mistaken diagnosis." I cannot believe this. We are all on the *qui vive* for yellow fever, which has been a yearly menace, for many years, from the French Colonies. When the disease has shown itself in epidemic form, it has, I think, been promptly diagnosed. In the Gambia, in 1900, I detected, I believe, the very first case, and notified the Government of my belief; and on the Gold Coast this year the disease was, I believe, promptly diagnosed. We do not need such signs as intense jaundice and black vomit in order to diagnose yellow fever, and do not wait for such symptoms. In the Gambian epidemic jaundice was not marked, and black vomit was markedly absent. One I know died, vomiting blood into my face, and I think a second had black vomit; but in the others—if my memory serves me—it was absent, and it was a very severe epidemic, 86 per cent. of my cases dying. To assert that there has been a universal conspiracy to deny the presence of yellow fever is a very grave assertion to make. What possible reason can the medical officers have for cloaking the disease? The responsibility on their shoulders is dreadful. I can well remember how I trembled like a leaf when I thought, in the pre-mosquito theory days of 1900, of the terrible ordeal I had to go through unaided, and of the deaths that would take place if I did not promptly turn the Europeans out of the place. The responsibility of placing the colony in quarantine was a trifle. Supposing I was wrong, I would lose my post; but what was that compared to the lives that would be lost if I neglected my duty. The two cases mentioned by Sir Rubert (in 1884 and 1903) are regrettable. In the first case it was one opinion differing from another on a single case (Sir Rubert does not mention if an epidemic followed). The second case certainly looks bad; but the two hardly seem to warrant Sir Rubert's conclusions. The executive authority must be, as I can well believe, slow to place a colony under quarantine, but I cannot imagine that it has ever refused to do so, once satisfied by the Medical Department of the existence of yellow fever. Sir Rubert maintains that we err, in being unable to differentiate between yellow and other fevers—such as "bilious remittent," "inflammatory," and other fevers. "Inflammatory or seasoning" fever I know nothing of, and am not the least aware that it is even considered necessary for Europeans to have a "seasoning" or any fever. "Bilious remittent" is to my mind very different from yellow fever, and I am inclined to think that Sir Rubert, in his anxiety to prove his point, classes as yellow fever cases of bilious remittent fever, in which, owing to the persistent and violent attacks of vomiting, black vomit has been present. The "yellow fever" of the natives I know well. It startles you at first when a native comes to you, and says he has "yellow fever." It is a mere bilious attack, it is not a fever.

(*To be continued.*)

## Report.

### THE ANNUAL REPORT OF LIVINGSTONE COLLEGE.

IN the annual report (1909-10) of Livingstone College, it is pointed out that only a very small number of missionaries annually avail themselves of the opportunities afforded by the college for medical training. This is not as it should be, because so many of these may in the future be far away from medical attention, and have to act entirely on their own initiative. Their own lives and the lives of others may be dependent on themselves, and if untrained it is not likely that they will be able to do much good. Such being the case, one cannot too strongly impress on all missionaries intending to proceed abroad the necessity of going to Livingstone College for a course of training in elementary medicine and hygiene.

At Commemoration Day at Livingstone College, June 11, 1910, a series of resolutions were passed, *nem. con.*, by the sectional meeting of medical delegates, medical missionaries, and other medical practitioners

interested in the medical aspects of missionary work. These are of such importance that they may be quoted in full here :—

(1) That all the Societies should send fully-qualified medical missionaries to every district where missionaries are located, when other qualified medical assistance is not available.

(2) That all missionaries going abroad should have that knowledge which shall enable them to safeguard their own health and that of their families.

(3) That those missionaries who are compelled to live in districts where there are no "medical missionaries," and where no medical or surgical assistance is available, should have that knowledge which shall enable them to treat minor ailments and accidents.

(4) That inasmuch as there are risks that missionaries should use this knowledge indiscreetly, or assume a position which they are not qualified to take, this training should be given in recognized institutions where the course of training is planned out suitably for the particular need, and where they will not be trained together with medical students.

(5) That Missionary Societies should not permit such missionaries to fill responsible posts, nor should they allow them, under any circumstances, to take upon themselves the title of "medical missionary," or assume the position of a qualified practitioner.

The Livingstone College has done good work in the past, and missionaries themselves must see that it is supported, and enabled to carry on this work in the future.

## Correspondence.

### TROPICAL INSURANCE PREMIUMS.

*To the Editor of the* JOURNAL OF TROPICAL MEDICINE AND HYGIENE.

SIR,—Your issue of 1st inst., with its report of the speech by Mr. Cantlie bearing on the above subject, has come before me, and I do not think it would be fair to life assurance companies to let the statements contained in the speech pass unchallenged. Possibly one need not regard an after-dinner speech from the same point of view as one delivered on a more formal occasion; but, at the same time, the statements made are so unfair that I shall be glad if you will insert this reply in your columns.

Mr. Cantlie is reported to have stated: "It is said that by those dropped insurances the companies live—a sordid method of profit, surely, if true, for it would seem that the breath of life of insurance companies is to do all they can to make their clients stop paying their insurance money. Any company will tell you that one policy in three reaches maturity, and it is by the fact that two-thirds of their clients drop out that they thrive and pay their dividends." I may say that the insinuation above made, and the statement that it is from dropped policies that insurance companies thrive, are both utterly unfounded. One would imagine that, of all the misconceptions which exist in the minds of the public regarding life assurance, the one which an intelligent speaker would be most unlikely to select is that which states that companies make their profits from lapsed policies. Surely common-sense shows that this would be the most suicidal method of making profits which could be discovered. Instead of doing what they can to encourage lapses, insurance companies follow exactly the opposite course of doing all they can to induce existing policy-holders to maintain their insurances, both by repeated applications for the premiums and, if these cannot be obtained, then by the various schemes devised to prevent forfeiture wherever possible. As a matter of fact, it is quite simple to calculate the profit which a company has made from lapses, and in many offices this is done. I have referred to the figures in connection with my own company since its foundation, and have found that the percentage of the total profits due to lapses and surrenders has been a very small one indeed. I may state that from the foundation of the company the shareholders have received on an average less than £100 per annum from this source.

With regard to Mr. Cantlie's suggestion for decreasing the sums assured instead of increasing the premiums on the life going to the Tropics, insurance companies could, of course, make some such arrangement. The objection is that the decrease in the sum assured required to meet any given increase in premiums would be so large that in practically no case would the proposer be willing to agree to the arrangement. By Mr. Cantlie's suggested method the extra risk would, in fact, be paid for only by those who died, while in the ordinary practice the usual method in insurance is followed of making all who incur extra risk combine to meet it.

Again, it is not correct to state that insurance companies guard themselves from loss by plans that are not founded on common-sense, but upon mere gossip or misleading statistics. No class is more alive to the necessity of charging fair premiums than the officials of modern insurance companies, and competition alone drives extra premiums down to a minimum. The complaint nowadays from those who have gone into the subject is that offices are tending to charge extra premiums which, through being too low, are not fair to the general body of their policy holders.

Needless to say, the offices are deeply interested in all that has been done towards the stamping out of tropical diseases, and this is an additional reason for my trespassing on your space.

Yours faithfully,
DAVID PAULIN,
*Manager.*

Scottish Life Assurance Co., Ltd.
19, St. Andrew Square, Edinburgh.

## Drugs and Appliances.

IN Messrs. Hearson and Co's. new supplementary catalogue just published a "New Wassermann Incubator" and a "New Anhydric Electric Incubator" are described. The former is described as a "New Opsonic Incubator for the Wassermann test, &c.," and should be found of the greatest use by those doing this test.

The apparatus consists of a strong copper vessel, nickel plated, on a stand. The incubator is a double-sided reservoir, and is provided with a glass front and back. It is intended to be used on a bench facing the light; the back is provided with two grooves for the insertion of different coloured glasses; for testing blood a red glass is used, and for toxins a blue glass. On the side of the apparatus a small tank is fixed, to which Hearson's Patent Thermostat and Capsule are attached. This is regulated for 56 to 60° C. for the sterilization of liquids, and is provided with two perforated plates, one to take ordinary test-tubes and the other for small tubes. It is also provided with a hinged cover held in place by a spring, which is laid over the wadded stoppings of the reagent glasses in order

that the tubes may remain in water and not become dried up.

The incubator itself is fitted with Hearson's Patent Thermostat and Capsule and is regulated for 38° C. Metal plates, which are interchangeable, are provided, with holes and slots of various sizes for the reception of narrow or wide reagent tubes.

A thermometer is provided for the two compartments, also two racks and two plates with holes and slots.

The whole forms a very useful and complete set for the study of the Wassermann process.

The "Anhydric Electric Incubator" will, the makers think, be hailed with satisfaction by bacteriologists. Apparatus constructed on this principle will heat up much quicker than those hitherto in use: Firstly, on account of the direct way in which the heat is applied; secondly, because there is no longer a large volume of water to be warmed; and thirdly, because the system permits of a much thicker layer of non-conducting (or heat insulating) material being introduced between the chamber to be heated and the external air, without unduly increasing the size of the apparatus.

Both internally and externally the new Anhydric Electric Incubators conform in design and appearance to the Model A Series, excepting only that there are no heating arrangements below the apparatus.

Both these incubators conform in all ways to the high standard of Messrs. Hearson and Co's. other work, and any one buying them will not be disappointed.

## Notes on Books.

THE TREATMENT OF SYPHILIS BY THE EHRLICH-HATA REMEDY, "606." Translated by Dr. M. D. Eder. Rebman, Ltd., 129, Shaftesbury Avenue, London, W.C.

This little work gives a very good summary of the work accomplished by this drug up to date. The reported matter is purely objective, and related chronologically, the reader being left to form his own judgment of the results. Recent reports from Paris have a tendency to throw some doubt on the reputed efficacy of "606," and the wisest plan apparently is to suspend judgment until time will show whether so-called cures are to be permanent or not.

CATALOGUE OF THE PATHOLOGICAL MUSEUM, SCHOOL OF MEDICINE, CAIRO.

Dr. A. R. Ferguson, pathologist to the School of Medicine at Cairo, has brought out an up-to-date catalogue of the Pathological Museum.

The author states in his preface that a small catalogue, containing the titles, with occasional short descriptions of specimens, was prepared by Dr. Symmers and Mr. Madden, primarily as a guide to the museum for the use of members of the International Medical Congress which was held in Cairo, in December, 1902. Since 1905 many new specimens have been added to the Museum, and the foregoing list had, therefore, gone out of date. The present catalogue was commenced in November, 1909, and will be found to contain an account of all specimens existing in the Museum at the end of March, 1910. The work should prove of great use to those studying in Cairo.

## Notes and News.

A SUM of £10,000, raised in commemoration of Dr. J. E. Dutton, who lost his life while engaged on tropical medicine researches on the Congo, has been offered to, and accepted by, the Liverpool University for the establishment of a chair of tropical entomology.

OF 159 cases in which the spleen was punctured for correct diagnosis of kala-azar in the Bunkipore General Hospital, Patna, ninety-two gave positive results. In four cases in which the liver was punctured the Leishman-Donovan body was found.

TWENTY-ONE deaths from pellagra are reported to have occured in Spartanburg, South Carolina, U.S.A., during 1910.

## Annotations.

MILLER, in the *Journal of the American Medical Association* (December 3, 1910), reports a human case of "myiasis dermatosa" due to the ox-warble flies. Cases of this condition in the human subject would seem to be rare, Miller only finding one other in the literature at his disposal. The patient, a boy, was admitted into the Johns Hopkins Hospital, Baltimore, complaining of a swelling under the chin. Some time before that he had noticed a lump below the left knee, this swelling gradually moving up to above the knee, then up the thigh, then up the abdomen, under the axilla, over the scapula, up the right side of the neck, irregularly about the scalp, then finally back to the submental region, which it reached two months after its first appearance below the knee. When examined a superficial, fluctuating mass with little induration or inflammation around it was seen. The mass was incised under cocaine, and a white larva lying in a cavity, possibly 1 cm. in diameter, was exposed, the situation being entirely in the skin. No motion was observed in the parasite. Professor Stiles, to whom the larva was sent, identified it as "the larva of *Hypoderma lineata* in the second stage."

Before applying for treatment a second larva had been voided; this one appeared first in the left groin, and passed from there to the occipital region, where it came to a head. The patient on picking off the scab pulled out the larva himself.

Wright of Boston, in the *Journal of the American Medical Association* for December 3, 1910, publishes revised directions for making and using the blood stain usually associated with his name. He proposes now to prepare the stain as follows:—

To a 0·5 per cent. aqueous solution of sodium bicarbonate add methylene blue (B. X. or "medicinally pure") in the proportion of 1 grm. of the dye to each 100 c.c. of the solution. Heat the mixture in a steam sterilizer at 100 C. for one full hour, counting the time after the sterilizer has become thoroughly heated. The mixture is to be contained in a flask, or flasks, of such size and shape that it forms a layer not more than 6 cm. deep. After heating, allow the mixture to cool, placing the flask in cold water if desired, and then filter it to remove the precipitate which has formed in it. It should, when cold, have a deep purple-red colour when viewed in a thin layer by transmitted yellowish artificial light. It does not show this colour while it is warm.

To each 100 c.c. of the filtered mixture add 500 c.c. of a ·1 per cent. aqueous solution of "yellowish, water-soluble" eosin and mix thoroughly. Collect the abundant precipitate which immediately appears on a filter. When the precipitate is dry, dissolve it in methylic alcohol (Merck's "reagent") in the proportion of ·1 grm. to 60 c.c. of the alcohol. In order to facilitate solution, the precipitate is to be rubbed up with the alcohol in a porcelain dish or mortar with a spatula or pestle.

This alcoholic solution of the precipitate is the staining fluid. It should be kept in a well-stoppered bottle because of the volatility of the alcohol. If it becomes too concentrated by evaporation and thus stains too deeply, or forms a precipitate on the blood-smear, the addition of a suitable quantity of methylic alcohol will quickly correct such faults. It does not undergo any spontaneous change other than that of concentration by evaporation, according to my personal experience.

A most important fault encountered in the working of some samples of this fluid is that it fails to stain the red blood-corpuscles a yellow or orange colour, but stains them a blue colour which cannot readily be removed by washing with water. This fault Wright has recently discovered to be due to a peculiarity of the eosin employed. It can be eliminated by using a proper "yellowish, water-soluble" eosin. Such an eosin can be obtained from R. L. Emerson, 739, Boylston Street, Boston.

This method, it will be seen, is practically similar to Leishman's modification of Romanowsky's stain used so much in England and the British colonies, and its application to blood-films is carried out in an exactly similar manner.

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In the *Indian Medical Gazette* for November, 1910 (vol. xlv., No. 11), Bentley and Taylor describe a new method of making permanent preparations of mosquitoes. In the new method the specimen is primarily fixed and coated with a thin covering of celloidin, which protects the mosquito from the clearing action of the balsam, and prevents the dislodgment of the scales and hairs. The natural appearance of the insect is thus preserved. After the celloidin has been applied—the legs and wings being arranged—the specimen is next ready for mounting, either in ordinary balsam or in a mixture of zinc oxide and balsam, which is less liable to penetrate the celloidin than ordinary balsam, and at the same time shows up the points of the specimen to advantage. To prepare this zinc balsam, the zinc oxide should be sifted through fine muslin, and a sufficient quantity added very gradually to xylol balsam until a thick, uniform, opaque white mixture has been obtained. A big drop of this is placed in the hollow of a slide which is then inverted upon the specimen ready prepared on the cover-slip—the hollow of the slide preventing the crushing of the specimen and saving the thorax from damage. As the balsam takes some time to harden the specimen should be kept face downwards for several days.

The authors believe that specimens preserved in the manner described above will be found to show all the points necessary for identification, will be able to be handled without risk of damage, and will be ideal for demonstrative purposes.

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William H. Smith, in the *Boston Medical and Surgical Journal* for November 24, 1910, describes a new method of staining capsulated bacteria in body fluids. The following is the method:—

(1) Make a thin smear from fresh sputum, lung, pleural, or pericardial exudate.

(2) Pass through flame.

(3) Cover with 10 per cent. aqueous solution of phosphomolybdic acid (Merck) four to five seconds.

(4) Wash in water.

If the micro-organism is Gram-staining like the pneumococcus or *Streptococcus mucosus capsulatus*, stain with:—

(5) Aniline oil gentian violet, steaming one-quarter to one-half minute.

(6) Wash in water.

(7) Treat with Gram's solution of iodine, steam one-quarter to one-half minute.

(8) Decolorize with 95 per cent. alcohol.

(9) Wash in water.

(10) Stain with 6 per cent. aqueous solution of eosin (Grübler's w. g.) one-half to one minute, warming gently.

(11) Wash in water.

(12) Wash in absolute alcohol.

(13) Clear in xylol and mount in Canada balsam. The capsule will be found to be distinct, clear cut, eosin stained, about the Gram-stained micro-organism.

If the micro-orgamism is Gram-decolorizing, after covering the smear with phosphomolybdic acid and washing—

(1) Stain with 6 per cent. aqueous solution of eosin one-half to one minute, warming gently.

(2) Wash in water.

(3) Counter-stain with Loeffler's methylene blue one-quarter to one-half minute, warming gently.

(4) Wash in absolute alcohol.

(5) Clear in xylol and mount in Canada balsam. The capsule will appear eosin stained about the blue-stained micro-organism.

A plate of micro-organisms illustrating the results obtained by the method undoubtedly shows the capsules up very clearly.

## PLAGUE.

### Prevalence of the Disease.

#### India.

| Week ended— | Deaths. |
|---|---|
| June 25 (1910) | 1,064 |
| July 2 | 1,002 |
| ,, 9 | 845 |
| ,, 16 | 497 |
| ,, 23 | 675 |
| ,, 30 | 620 |
| Aug. 6 | 688 |
| ,, 13 | 1,084 |
| ,, 20 | 1,057 |
| ,, 27 | 1,385 |
| Sept. 3 | 1,845 |
| ,, 10 | 1,988 |
| ,, 17 | 2,337 |
| ,, 24 | 2,992 |
| Oct. 1 | 2,820 |
| ,, 8 | 3,075 |
| ,, 15 | 2,904 |
| ,, 22 | 3,580 |
| ,, 29 | 4,270 |
| Nov. 5 | 4,823 |
| ,, 12 | 5,342 |
| ,, 19 | 6,104 |

| Week ended | Bombay Presidency | Bengal | United Provinces | Punjab | Central Provinces | Central India | Rajputana | Madras Presidency | Burma | Hyderabad | Mysore |
|---|---|---|---|---|---|---|---|---|---|---|---|
| June 25 | 152 | 34 | 22 | 608 | 12 | .. | 24 | 38 | 104 | 70 | .. |
| July 2 | 114 | 11 | 33 | 582 | 10 | .. | 58 | 32 | 102 | 62 | .. |
| ,, 9 | 110 | 68 | 27 | 287 | 18 | .. | 161 | 39 | 90 | 45 | .. |
| ,, 16 | 153 | 36 | 29 | 13 | 43 | .. | 30 | 25 | 82 | 84 | .. |
| ,, 23 | 217 | 31 | 54 | 21 | 42 | .. | 24 | 39 | 84 | 163 | .. |
| ,, 30 | 185 | 30 | 78 | 12 | 40 | .. | 35 | 33 | 66 | 141 | .. |
| August 6 | 204 | 41 | 121 | 21 | 70 | 10 | 76 | 26 | 62 | 57 | .. |
| ,, 13 | 331 | 50 | 93 | 27 | 109 | 30 | 91 | 50 | 63 | 140 | .. |
| ,, 20 | 350 | 56 | 94 | 44 | 114 | 70 | 112 | 77 | 47 | 93 | .. |
| ,, 27 | 549 | 65 | 87 | 30 | 269 | 85 | 137 | 60 | 35 | 68 | .. |
| September 3 | 857 | 85 | 164 | 20 | 248 | 110 | 164 | 73 | 40 | 84 | .. |
| ,, 10 | 828 | 96 | 135 | 64 | 402 | 99 | 180 | 74 | 42 | 70 | .. |
| ,, 17 | 868 | 81 | 121 | 174 | 550 | 116 | 208 | 121 | 19 | 39 | .. |
| ,, 24 | 809 | 53 | 119 | 158 | 522 | 221 | 372 | 147 | 16 | 75 | .. |
| October 1 | 942 | 60 | 190 | 117 | 510 | 286 | 475 | 146 | 13 | 85 | .. |
| ,, 8 | 948 | 79 | 203 | 281 | 417 | 201 | 600 | 118 | 27 | 202 | .. |
| ,, 15 | 1,024 | 81 | 152 | 289 | 406 | 175 | 449 | 111 | 22 | 195 | .. |
| ,, 22 | 1,162 | 104 | 294 | 301 | 430 | 403 | 566 | 95 | 23 | 216 | .. |
| ,, 29 | 1,043 | 115 | 376 | 602 | 587 | 167 | 586 | 116 | 34 | 316 | 328 |
| November 5 | 1,013 | 174 | 737 | 740 | 650 | 160 | 562 | 208 | 42 | 211 | 336 |
| ,, 12 | 1,024 | 200 | 1,022 | 856 | 734 | 158 | 503 | 282 | 45 | 158 | 358 |
| ,, 19 | 857 | 358 | 1,298 | 840 | 780 | 135 | 602 | 387 | 51 | 361 | 435 |
| Twenty-two weeks | 13,740 | 1,908 | 5,452 | 6,087 | 6,963 | 2,426 | 6,010 | 2,307 | 1,119 | 2,945 | 1,457 |

In India the total mortality from plague during the following months was: July, 3,580; August, 4,768, 8,405 and 14,075.

*Japan.*—During April, May and June, fresh cases, twenty-two; deaths, seventeen.

*Formosa.*—During April, May and June, seventeen cases and thirteen deaths.

*China.*—During the summer of 1910 plague prevailed with varying intensity in Pakhoi (severe), Chao Yung (severe); less severe in Hankow, Amoy, Shanghai, Canton, Tsingtan, Nanking, Fatchow, Sun Ui district; Sunning district (severe), Hsin Hin (severe).

*Manchuria.*—In November, 1910, plague reported to be epidemic.

*Hong Kong.*—Declared free from plague on September 10, 1910.

*Straits Settlements.*—Six cases reported. Singapore declared free from plague on June 22.

*Siam.*—Between November 1, 1909, and June 30, 1910, the fresh cases numbered 108, and the deaths, 101.

*Persia.*—Part of Bushire declared free from plague on July 2.

*Turkey in Asia.*—Plague reported at Djedda, Loheia, Hadhur, and Bara during the summer of 1910. There were thirty-two deaths reported, but at Hadhur, near Loheia, a serious epidemic prevailed.

*Egypt.*—Between July 1 and August 12 the fresh cases of plague numbered eighty-five and thirty-five deaths.

*Tunis.*—A few imported cases.

*Mauritius.*—Between August 1 and December 8 the number of fresh cases of plague numbered 387, and the deaths from the disease 215. The numbers according to months were: August, eight cases and five deaths; September, thirty-seven cases and twenty-six deaths; October, 124 cases and sixty-nine deaths; November, 156 cases and eighty-six deaths; to December 8, fifty-six cases and twenty-nine deaths. From January 1, 1910, to December 8, the fresh cases numbered 508, and the deaths 323.

*Russia.*—During June, July and August the fresh cases in Odessa and Astrachan districts numbered twenty-two, and the deaths, nineteen.

*England.*—Four deaths from pneumonic plague in Suffolk during September.

#### South America.

*Brazil.*—Three cases in April.

*Ecuador.*—Six cases in June.

*Venezuela.*—Plague in Caracas in July and August.

*Peru.*—October 1, 1909, to April 1, 1910, 379 fresh cases, ninety-five deaths.

# Personal Notes.

INDIA OFFICE.

*Arrivals Reported in London.*—Captain R. Steen, I.M.S., B.; Lieutenant-Colonel H. P. Dimmock, I.M.S., Bo.; Major S. H. Burnett, I.M.S., Bo.; Lieutenant-Colonel A. C. Younan, I.M.S.; Lieutenant-Colonel R. C. MacWatt, I.M.S., B.; Captain J. C. S. Oxley, I.M.S., B.; Captain L. P. Stephen, I.M.S., Bo.; Captain R. S. Kennedy, I.M.S.; Lieutenant-Colonel W. Vost, I.M.S., B.; Lieutenant-Colonel E. O. Thurston, I.M.S., B.; Lieutenant-Colonel J. J. Pratt, I.M.S., B.; Captain C. H. Reinhold, I.M.S.

*Extensions of Leave.*—Lieutenant-Colonel J. Chaytor-White, I.M.S., B., 6 m., M.C.; Major P. Dee, I.M.S., B., 2 m., M.C.; Captain M. J. Quirke, I.M.S., M., 5 days; Captain F. W. Cragg, I.M.S., M., 4 m., M.C.

*Permitted to Return.*—Captain M. J. Quirke, I.M.S.; Captain L. B. Scott, I.M.S., B.

LIST OF INDIAN MILITARY OFFICERS ON LEAVE.

*Showing the Name, Regiment or Department, and the Period for which the Leave was granted.*

Anderson, Captain D. N., I.M.S., to July 24, 1911.

Kennedy, Captain R. S., I.M.S., 12 m., from October 12, 1910.

Reinhold, Captain C. H., I.M.S., 12 m., from November 15, 1910.

LIST OF INDIAN CIVIL OFFICERS ON LEAVE (INCLUDING MILITARY OFFICERS UNDER CIVIL RULES.)

*Showing the Name, Province, and Department, and the Period for, and Date from, which the Leave was granted.*

Bryson, Major R., I.M.S., M.

Burnett, Major S. H., I.M.S., Bo., 24 m., October 4, 1910.

Dimmock, Lieutenant-Colonel H. P., I.M.S., Bo., 6 m. 28 d., October 15, 1910.

Hudson, Lieutenant-Colonel E., I.M.S., U.P., 24 m., November 8, 1909.

MacWatt, Lieutenant-Colonel R. C., I.M.S., India Foreign.

Oxley, Captain J. C. S., I.M.S., C.P.

Smith, Major F. A., I.M.S., Beloochistan.

Steen, Captain R., I.M.S., U.P., 12 m., October 13, 1910.

Thurston, Captain E. O., I.M.S., B.

Vost, Lieutenant-Colonel W., I.M.S., U.P.

COLONIAL MEDICAL SERVICES.

*West African Medical Staff.*

*Deaths.*—T. E. Fraser Toovey, F.R.C.S., L.R.C.P.Edin., L.F.P.S Glas., L.M.Irel., Medical Officer, Southern Nigeria; F. C. Hepburn, M.R.C.S.Eng., L.R.C.P.Lond., Medical Officer, Southern Nigeria.

*Retirement.*—W. S. Snell, L.R.C.S., L.R.C.P.Edin., L.F.P.S. Glas., Medical Officer, Southern Nigeria.

*Resignation.*—F. M. Simmonds, L.S.A.Lond., M.B.Edin., Medical Officer, Gold Coast, resigns his appointment, receiving a gratuity.

*No Transfers.*

*Promotions.*—W. H. G. H. Best, L.R.C.S.,L.R.C.P.Irel.,Senior Medical Officer, Southern Nigeria, to be Provincial Medical Officer, Southern Nigeria; C. R. Chichester, M.B.Dublin, L.R.C.S., L.R.C.P.Irel., D.P.H.Dubl., Senior Medical Officer, Southern Nigeria, to be Provincial Medical Officer, Southern Nigeria.

*New Appointment.*—H. C. Jeffreys, B.A.Oxon., M.R.C.S. Eng., L.R.C.P.Lond., formerly a Medical Officer in British Honduras, has been selected for appointment to the Staff, and posted temporarily to Sierra Leone

Dr. J. P. B. Snell has become a Medical Officer in the service of the Government of Southern Nigeria.

Dr. W. Lutsch has been appointed to the post of District Surgeon, Lindley, in the Province of the Orange Free State, South Africa.

THE SOCIETY OF TROPICAL MEDICINE AND HYGIENE.

At a meeting of the Society of Tropical Medicine and Hygiene, held at 11, Chandos Street, Cavendish Square, London, W., on Friday, December 16, 1910, at 8.30 p.m., the following gentlemen were elected Fellows of the Society: Howard G. Barrie, M.D., Kuling, China; Charles R. Chichester, M.B., Nigeria; Arthur F. Cole, M.R.C.S., Ningpo; Captain A. E. Hamerton, R.A.M.C., London; Edward Hicks Hume, M.D., Yale Mission, Hunan; Thos. H. Johnson, B.Sc., Sydney; George W. McCoy, M.D., San Francisco; Carl T. Möller, M.B., Germiston, Transvaal; C. Vere Nicoll, M.R.C.S., Kajang, F.M.S.; William Oscar Pou, M.D., Kuantan, F.M.S.; C. H. D. Ralph, M.R.C.S., Seccondee, Gold Coast; George J. Rutherford, M.R.C.S., Coomassie; Frank Tidswell, M.B., Sydney; Captain J. R. J. Tyrrell, I.M.S.

# Recent and Current Literature.

*A list of recent publications and articles bearing on tropical diseases is given below. To readers interested in any branch of tropical literature mentioned in these lists the Editors of the* JOURNAL OF TROPICAL MELICINE AND HYGIENE *will be pleased, when possible, to send, on application, the medical journals in which the articles appear.*

**"Münchener Medizinische Wochenschrift," October, 1910.**

THE WASSERMANN REACTION IN THE TROPICS.

G. Baermann and N. Wetter found positive Wassermann reactions in many cases of persons suffering from yaws and leprosy in Sumatra. In malaria, also, positive reactions obtained, but syphilis was believed to be also present in most of the malaria cases.

**"British Medical Journal," December, 17, 1910, p. 191.**

Spitzly describes a case of acute poisoning by *Trachinus vipera* (a poisonous fish) in Normandy.

His son was stung on the index finger of the right hand. Immediately after this severe nauseating pain, going up the hand and arm to the shoulder, was complained of. An hour after the accident the finger had swelled up, was of a dark-blood colour, was very painful, the hand was swollen up to the wrist, and the boy felt very faint and ill. Dr. Spitzly incised the swollen tissues with a scalpel and encouraged bleeding, in another hour the pain being less. Subsequent treatment consisted in bathing the hand and forearm with permanganate of potash and carbolic-acid solutions alternately. The swelling remained for a fortnight after the injury, and the wound only healed after six weeks.

**"Inter State Medical Journal," December, 1910.**

Hollebeke writes on "Human Trypanosomiasis" in the Belgian Congo. He states that the disease is ravaging the entire extent of the Belgian Congo Colony. After a description of some of the clinical features seen in the disease, the author touches on prophylaxis, and finishes up with the expression of opinion that atoxyl has had the most favourable results as a drug.

**"Sleeping Sickness Bulletin," December 6, 1910 (No. xxii., 1910, vol. II).**

The above issue of the Bulletin contains the following items: (1) The transmission of trypanosomes. (2) *Trypanosoma rhodesiense.* (3) Auto-agglutination. (4) Treatment of trypanosome infections. (5) The action of serums in trypanosome infections. (6) Bionomics of Glossina. (7) Trypanosomiases of animals. (8) Acclimatization of *T. lewisi* in new vertebrate hosts, and other papers. (9) Sleeping sickness news, Nyasaland, Belgian Congo, French Congo, Kaffir beliefs. (10) Annotation. (11) Monthly list of references.

# Notices to Correspondents.

1.—Manuscripts sent in cannot be returned.

2.—As our contributors are for the most part resident abroad, proofs will not be submitted to those dwelling outside the United Kingdom, unless specially desired and arranged for.

3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.

4.—Authors desiring reprints of their communications to the JOURNAL OF TROPICAL MEDICINE AND HYGIENE should communicate with the Publishers.

5.—Correspondents should look for replies under the heading 'Answers to Correspondents."

# Original Communications.

## REMARKS ON THE POSSIBLE PLURALITY OF SPECIES OF THE TRYPANOSOMES AFFECTING MAN IN AFRICA.

By Aldo Castellani, M.D.

*Director of the Clinic for Tropical Diseases, Colombo, Ceylon.*

Dr. George C. Low has recently suggested that the trypanosomes found in Rhodesia and Nyasaland, where *Glossina palpalis* has not yet been observed, may be a different species from *Trypanosoma gambiense*. While agreeing with Dr. Low, I feel inclined to go further and revive my old hypothesis of 1903, viz., that also in *G. palpalis* districts there may be more than one species of human trypanosome, possibly transmitted by the same fly, in the same manner as different species of malaria parasites are transmitted by the same mosquito. Experience in parasitology and bacteriology teaches that very frequently what was considered at one time to be a single species was in reality a group of specifically different, though closely related, organisms; I may mention the malarial parasite among the protozoa, the dysentery bacillus among the bacteria, the *Trichophyton tonsurans* among the higher fungi. In my publications of 1903 on the trypanosome of Sleeping Sickness,[1] I stated that in analogy to what takes place in the lower animals, for instance, the horse, I believed that man also could be infected by different species of trypanosomes; in fact, I considered at the time that in Equatorial Africa there were probably at least two different species of trypanosome infecting man: *T. gambiense* and *T. ugandense*. Kruse was of the same opinion. I am well aware that the animal experiments of Dutton, Todd, Laveran and Mesnil did not support my belief, but it is to be noted that these experiments were carried out with comparatively few strains; it might be worth while to repeat the experiments on a larger scale using numerous strains, and taking into consideration other factors besides the animal reactions.

There cannot be any doubt, in my humble opinion, that under the name of *T. gambiense* have been collected strains, morphologically, widely different. As an example I might refer to a strain seen in Uganda by Baker, Moffat, Sir David Bruce, Nabarro, and myself, and characterized by being comparatively so short that the term *T. parvum* might very well be applied to it. The patient who harboured it, a European in charge of the Botanical Gardens of Entebbe, had a very irregular fever, but showed no clear symptoms of sleeping sickness. He was granted sick leave. He left Uganda with me, and we went to Trieste by the same steamer. From Trieste he went to London where he died, if I well remember, at the Seamen's Hospital. On board his condition was always serious between Mombasa and Trieste, but he never showed typical symptoms of sleeping sickness, such as drowsiness and tremor of the tongue and hands. Blood from the finger was twice taken on board, and the films examined later on showed the same type of trypanosome as that observed in Uganda. This trypanosome is very short, its length rarely exceeding 17·5 microns. In Uganda a monkey was inoculated with this strain by Sir David Bruce and Nabarro; the trypanosome developed in the monkey, showing the same peculiarities of shape and size.

In conclusion, I would suggest that further researches should be carried out with as many strains as possible, with the object to decide whether in Tropical Africa there is only one species of human trypanosome, or whether, as I think more probable, there are several species.

[1] Journal of Tropical Medicine, "Reports to the Royal Society," *Cent. f. Bacter.* &c.

## TRYPANOSOME DISEASES OF DOMESTIC ANIMALS IN UGANDA.[2]

*Trypanosoma uniforme, sp. nov.*

By Colonel Sir David Bruce, C.B., F.R.S., A.M.S.; Captains A. E. Hamerton, D.S.O., and H. R. Bateman, R.A.M.C.; and Captain F. P. Mackie, I.M.S.

(Sleeping Sickness Commission of the Royal Society, Uganda, 1908-10).

### Introduction.

The name *Trypanosoma uniforme* has been given to this species on account of the uniformity in shape and general appearance which characterizes it.

Only four oxen were found by the Commission to show this trypanosome in their blood. One was received from Sir Apolo Kagwa, K.C.M.G., the Prime Minister, on August 30, 1909, and its blood at once inoculated into a series of animals. The other three came from the Uganda Company's estate at Namukekera.

The ox, goat and sheep were found to be susceptible, while the monkey, dog, guinea-pig, rat, and mouse proved refractory. This was the case with *Trypanosoma vivax*, and in truth these two species resemble one another very closely. *Trypanosoma uniforme* differs from *T. vivax* in size, and perhaps to a slight extent in shape; but, from the small amount of material at the disposal of the Commission, it would be rash to generalise.

The few facts gathered will, therefore, be put on record, in order to draw the attention of future workers on Uganda trypanosomes to its presence.

### Morphology of Trypanosoma uniforme.

#### A. *Living, Unstained.*

This is a small and active trypanosome, which has a marked translatory movement in the field of the microscope. This movement, however, is not to be compared with that of *T. vivax* in point of rapidity or range. The rapid vibratory movement of the body and flagellum sometimes slows down for a perceptible fraction of time; but this trypanosome does not become completely quiescent as is commonly the case with *T. pecorum*. The cell contents are clear and homogeneous, without any appearance of a vacuole.

[2] A communication read before the Royal Society, December 8, 1910.

B. *Fixed and Stained.*

*Length.*—This trypanosome is smaller than *T. vivax*. The average is 16·0 as against 23·7 microns. The following table gives the average length of this trypanosome in the ox, goat, and sheep. Twenty trypanosomes are drawn and measured from each preparation, the average length reckoned, and the length of the longest and shortest given :—

TABLE I.—TRYPANOSOMA UNIFORME.

| No. of experiment | Animal | Method of fixing | Method of staining | In Microns | | |
|---|---|---|---|---|---|---|
| | | | | Average length | Maximum length | Minimum length |
| 1437 | Ox | Osmic acid | Giemsa | 16·0 | 17·5 | 15·0 |
| 1442 | ,, | ,, | ,, | 16·0 | 18·0 | 14·3 |
| 1442 | ,, | ,, | ,, | 16·3 | 19·0 | 14·0 |
| 1581 | ,, | ,, | ,, | 16·5 | 19·0 | 14·0 |
| 1732 | ,, | ,, | ,, | 15·5 | 17·5 | 13·5 |
| 1734 | ,, | ,, | ,, | 15·3 | 17·0 | 14·0 |
| 1689 | Goat | ,, | ,, | 16·4 | 17·5 | 15·0 |
| 1694 | ,, | ,, | ,, | 17·7 | 19·0 | 16·0 |
| 1694 | ,, | ,, | ,, | 14·7 | 16·0 | 13·0 |
| 1497 | Sheep | ,, | ,, | 17·8 | 19·0 | 16·0 |
| 1497 | ,, | ,, | ,, | 14·7 | 16·0 | 12·0 |
| | | | | 16·0 | 19·0 | 12·0 |

The following table represents the distribution in respect to length of 200 individuals of this species of trypanosome :—

TABLE II.—DISTRIBUTION IN RESPECT TO LENGTH OF 200 INDIVIDUALS OF TRYPANOSOMA UNIFORME.

| No. of experiment | Microns | | | | | | | | Average, in microns |
|---|---|---|---|---|---|---|---|---|---|
| | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | |
| 1437 ... | — | — | — | 5 | 10 | 5 | — | — | 16·0 |
| 1442 ... | — | — | 3 | 2 | 9 | 4 | 2 | — | 16·0 |
| 1442 ... | — | — | 1 | 6 | 5 | 5 | 1 | 2 | 16·3 |
| 1581 .. | — | — | 1 | 3 | 8 | 2 | 4 | 2 | 16·5 |
| 1734 ... | — | — | 4 | 8 | 6 | 2 | — | — | 15·3 |
| 1689 ... | — | — | — | 3 | 6 | 11 | — | — | 16·4 |
| 1694 ... | — | — | — | — | 2 | 5 | 9 | 4 | 17·7 |
| 1694 ... | — | 1 | 8 | 7 | 4 | — | — | — | 14·7 |
| 1497 ... | — | — | — | — | 4 | 7 | 8 | 1 | 17·8 |
| 1497 .. | 1 | — | 7 | 6 | 6 | — | — | — | 14·7 |
| Totals ... | 1 | 1 | 24 | 40 | 60 | 41 | 24 | 9 | ... |
| Percentages | 0·5 | 0·5 | 12·0 | 20·0 | 30·0 | 20·5 | 12·0 | 4·5 | ... |

*Breadth.*—Varies from 1·5 to 2·5 microns.

*Shape.*—This species of trypanosome seems to differ in shape from *T. vivax*, in that there is not the marked narrowing or constriction opposite the nucleus. The posterior extremity is rounded or blunt, and in this resembles *T. vivax*.

*Contents of Cell.*—Resembles *T. vivax* in showing the appearance of clear protoplasm with fine alveolar structure.

*Nucleus.*—Oval in shape and compact; not, as a rule, situated in a narrowed part of the body or waist, as in *T. vivax*. It also seems to be placed about the centre of the body, and does not take up the whole width of the cell as in the closely allied species.

*Micronucleus.*—Resembles *T. vivax* in being large, round, and terminal.

*Undulating Membrane.*—Narrow and little developed, as in *T. vivax*.

*Flagellum.*—There is a well-marked flagellum, the free part varying from 2 to 5 microns in length.

ANIMALS SUSCEPTIBLE TO TRYPANOSOMA UNIFORME.

| Date | No. of experiment | Source of virus | Period of incubation, in days | Duration of disease, in days* | Remarks |
|---|---|---|---|---|---|
| | | *Cattle.* | | | |
| 1909 Aug. 7 | 1442 | Nat. infec. | ? | 5 | Died of *T. uniforme* |
| ,, 30 | 1581 | ,, | ? | 61 | Killed |
| ,, 11 | 1732 | ,, | ? | 79 | Died of *T. uniforme* |
| ,, 11 | 1734 | ,, | ? | 80 | Killed |
| | | *Goat.* | | | |
| Sept. 1 | 1491 | Ox 1581 | 15 | 18 | No *post mortem* |
| ,, 16 | 1689 | ,, | 18 | 34 | ,, ,, |
| ,, 18 | 1694 | Goat 1491 | 9 | 35 | ,, ,, |
| ,, 24 | 1716 | Ox 1581 | — | — | Never showed trypanosomes; under observation 40 days |
| | | Average ... | 14 | 29 | |
| | | *Sheep.* | | | |
| Sept. 16 | 1497 | Ox 1581 | 18 | 46 | Killed |
| ,, 1 | 1601 | ,, | — | — | Never showed trypanosomes; died 10 days after inoculation |
| ,, 24 | 1717 | ,, | — | — | Never showed trypanosomes; died 13 days after inoculation |
| | | *Monkey.* | | | |
| Sept. 1 | 1653 | Ox 1581 | — | — | Experiment stopped after 34 days |
| | | *Dog.* | | | |
| Sept. 1 | 1600 | Ox 1581 | — | — | Experiment stopped after 34 days |
| | | *Guinea-pig.* | | | |
| Sept. 1 | 1599 | Ox 1581 | — | — | Experiment stopped after 34 days |
| | | *Rat.* | | | |
| Sept. 1 | 1597 | Ox 1581 | — | — | Experiment stopped after 34 days |
| | | *Mouse.* | | | |
| Sept. 1 | 1598 | Ox 1581 | — | — | Experiment stopped after 34 days |

* Duration includes the days of incubation; it dates from the day of infection.

CULTIVATION OF T. UNIFORME.

No attempt was made to cultivate *T. uniforme*.

CARRIER OF T. UNIFORME.

No experiments were made in the laboratory with *Glossina palpalis* as a carrier of *T. uniforme*, and no evidence is to hand as to what the carrier is.

### Conclusions.

(1) *Trypanosoma uniforme* resembles *T. vivax* in shape and general appearance, but differs markedly in size.

(2) It also resembles *T. vivax* in not being pathogenic to the smaller laboratory animals.

(3) There is no evidence available, as in the case of *T. vivax*, as to what the carrier of *T. uniforme* is.

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## NOTES ON THE HUMAN TRYPANOSOME OF NORTHERN RHODESIA.

By L. E. W. Bevan, M.R.C.V.S. (Southern Rhodesia).

*Post-Graduate of the Royal Veterinary College, London, and Pasteur Institute, Paris.*

*Source of Virus.*—The virus used to originate the strain of human trypanosomiasis at this laboratory was obtained from a European who, arriving in Southern Rhodesia from the North in November last, was found to be suffering from trypanosomiasis. This case was of considerable interest, inasmuch as there appeared grave reason to suppose that the patient had contracted the disease in Northern Rhodesia in an area thought to be free from *Glossina palpalis*. In these circumstances it became a matter of grave importance to determine the identity of the trypanosome with which he was infected and the manner of its transmission in Nature.

*Transmission through Animals.*—A supply of blood having been obtained by the courtesy of Dr. Heygate Ellis, of the Medical Department, a number of laboratory animals were inoculated, and among others, sheep and a mule; the facility with which these latter became infected opened up the question as to the part played by the lower animals in connection with human trypanosomiasis in Nature. Shortly after these experiments commenced it was announced that Bruce and his colleagues, working in Uganda, had found that cattle in the "fly area" (*G. palpalis*) did naturally harbour *T. gambiense*—a discovery which rendered the study of sleeping sickness a legitimate branch of work in a veterinary laboratory.

The results obtained here have been of some interest and have shown that not only are some of the domestic animals readily susceptible to this human trypanosome, but that artificial inoculation gives rise in them to symptoms no less severe than those caused by infection with the animal trypanosomes.

It has been possible to keep under observation at the same time sheep inoculated with the so-called *T. dimorphon* of North-Western Rhodesia, and the animal trypanosome of these territories, and it has been found that the disease arising in sheep inoculated with the human trypanosome has been more acute and characterized by more severe symptoms.

Similarly a mule offered no resistance to a single inoculation with the human parasite which produced a far more severe reaction than the animal trypanosome of Southern Rhodesia to which equines appear to possess a marked resistance.

*Virulence of Strain.*—From an examination of charts of sub-inoculated animals it would appear that the strain is of quite exceptional virulence—an observation which coincides with the experience of those medical officers who have studied the disease in human subjects in the field.

Compared with the recorded results of previous experiments with *T. gambiense*, the period of incubation and the duration of the disease appear to be unusually short, as indicated by the following averages:—

| Animal | Average period of incubation | Average duration of disease |
|---|---|---|
| Rabbit ... ... ... | 7 days | 24 days |
| Guinea-pig ... ... | 8 ,, | 38 ,, |
| Rat ... ... ... | 5½ ,, | 36 ,, |
| Mule ... ... ... | 6 ,, | about 100 ,, |
| Sheep ... ... ... | 6 ,, | 47 ,, |

The above figures are only approximate, as in some animals the course of the disease has been modified by treatment, and the intensity of the virus has been altered from time to time by passage through various species of host. In sheep severe infection is not always associated with the appearance of trypanosomes in the peripheral blood, and the period of incubation can then only be based upon the first definite elevation of temperature.

*Symptoms.*—In most cases the disease runs an acute course, or, after a preliminary stage when symptoms have not been well marked, has terminated by crisis. In rabbits and sheep there is a remarkable œdema of the face, especially that part situated between the eyes and nostrils. The photographs give a good idea of the characteristic appearance presented. In other trypanosomiases œdema at the base of the ears and around the nose occur, but the extent and situation of the swelling in these cases appears to be exceptional. In those sheep which have shown no other symptom save the irregularly elevated temperature, and where trypanosomes have not been found in the peripheral blood, the swelling of the head has enabled one to recognize infection. If this symptom holds good in natural circumstances, it should assist in the detection of "reservoirs" in those areas where prophylactic measures are being adopted. An elevated temperature has also been present in all cases, but examination of a large number of charts does not reveal any characteristic thermal wave, nor has it been possible to recognize any relation between temperature and the appearance of trypanosomes in the peripheral blood. In sheep, for example, the disease may run its course without any parasite being detected in the blood; although a small quantity used for the sub-inoculation of rabbits will give rise to an infection characterized by an abundance of trypanosomes in the blood.

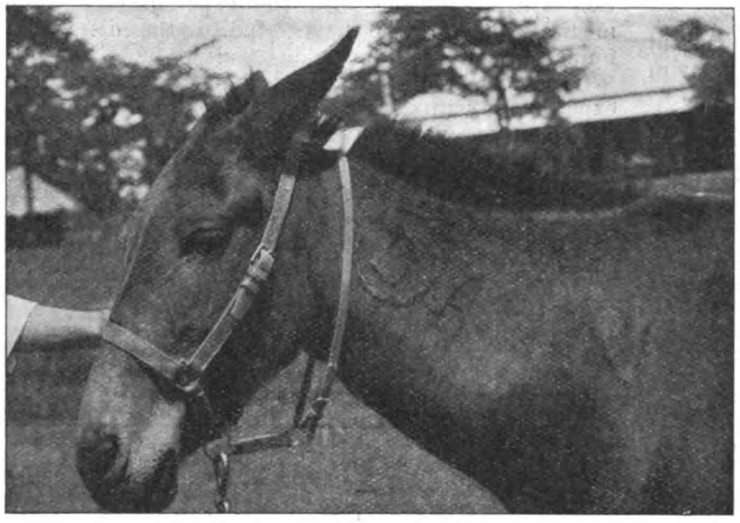
### Human Trypanosomiasis.

*Subject.*—Black sheep with lamb at heel.

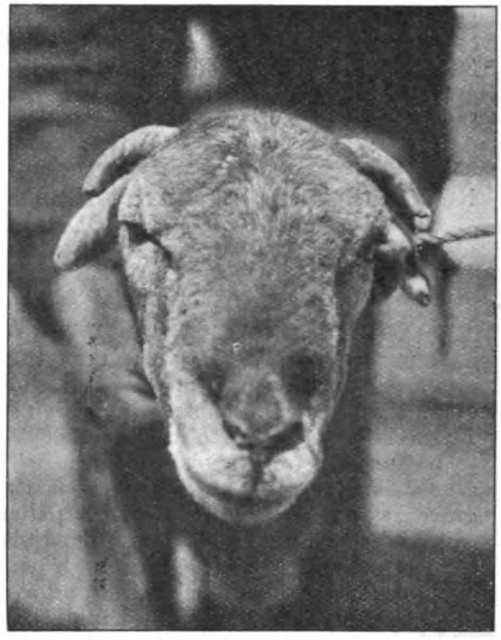
*Virus.*—3 c.c. warm citrated blood from brown buck rabbit.

*Date.*—August 2, 1910.

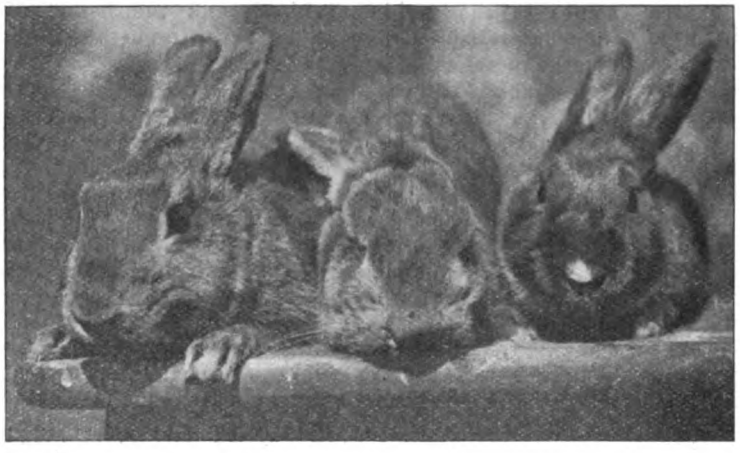
In one or two rabbits somnolence has occurred, and in some of the sheep brain symptoms have predominated during the last few days.



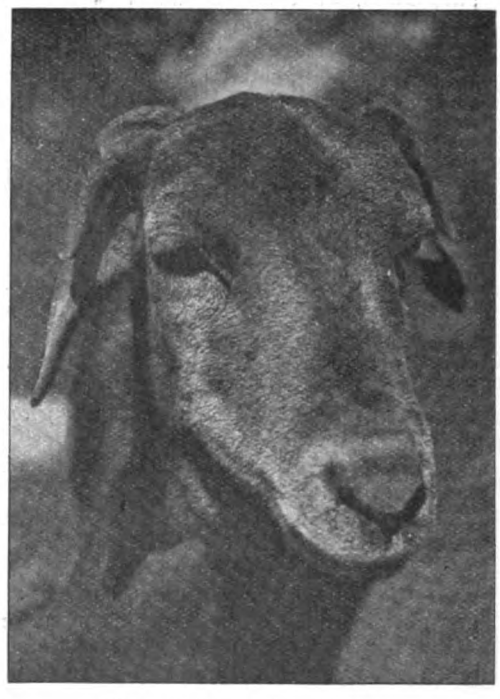
Early stage of infection in a mule.



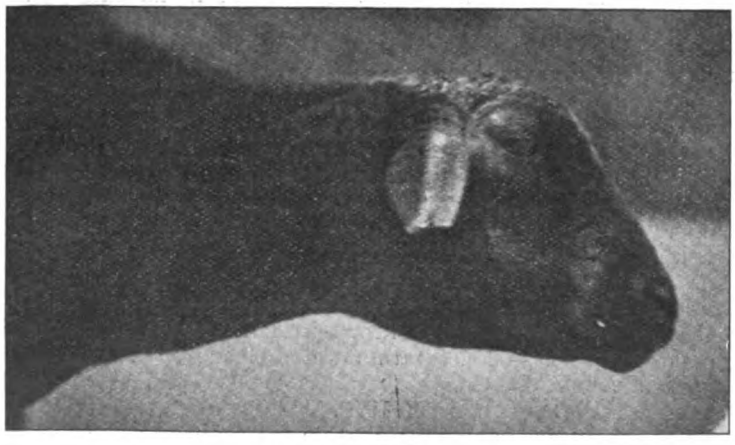
Characteristic œdema of face.



Centre rabbit infected. Rabbit on right early stage of infection. Rabbit on left healthy.



Characteristic œdema of face.



Œdema of head and neck.

PHOTOGRAPHS ILLUSTRATING THE REMARKABLE ŒDEMA OF THE FACE IN SHEEP AND RABBITS INOCULATED WITH THE HUMAN TRYPANOSOME OF NORTHERN RHODESIA.

In other respects the symptoms are those common to animal trypanosomiases.

| Date | Temperature | Remarks |
|---|---|---|
| August 3 ... | 102·4 | |
| ,, 4 ... | 103 | |
| ,, 5 ... | 104·5 | |
| ,, 6 ... | 105·2 | |
| ,, 8 ... | 104 | |
| ,, 9 ... | 102·6 | |
| ,, 10 ... | 104·8 | |
| ,, 11 ... | 104·8 | |
| ,, 12 ... | 104·4 | Rabbit inoculated with 2 c.c. blood. |
| ,, 13 ... | 104·8 | |
| ,, 15 ... | 105·8 | Above rabbit shows trypanosomes. |
| ,, 16 ... | 105·8 | |
| ,, 17 ... | 106 | |
| ,, 18 .. | 106 | |
| ,, 19 ... | 105·4 | |
| ,, 20 ... | 105·8 | |
| ,, 22 ... | 105·8 | |
| ,, 23 ... | 106·2 | Above rabbit dead. |
| ,, 24 ... | 105 | Œdema of throat. Typical swelling of head. |
| ,, 25 ... | 105·8 | |
| ,, 26 ... | 106 | |
| ,, 27 ... | 106 | |
| ,, 29 ... | 105 | |
| ,, 30 .. | 105 | Very ill. Œdema of head and neck. |
| ,, 31 ... | 104·8 | |
| September 1... | 102·4 | |
| ,, 2 .. | ... | Dead. |

*Trypanosomes never found in peripheral blood.*

*Identity of the Trypanosome.*—It has been suggested that the human trypanosome of Northern Rhodesia may not be *T. gambiense* but some animal trypanosome (*e.g.*, *T. brucei*) habituated by the method of transmission or passage, to the human host. This possibility has been borne in mind since the commencement of experiments at this laboratory, and from time to time material has been sent to experts in Europe with the view to establishing the identity of the parasite.

*Morphology.*—The endeavour has been made to classify the parasite by careful study of its morphology, but up to the present no features have been detected which would justify one in differentiating it from *T. gambiense*; moreover, it has been felt that the utmost caution should be taken in this respect, inasmuch as the too hasty announcement of the discovery of a new trypanosome pathogenic to man would naturally cause considerable alarm and economic loss in those countries threatened by its invasion.

Minchin in a "Note on the Polymorphism of *T. gambiense*" (*Parasitology*, vol. i., No. 3, p. 326), recognizes three typical forms of this trypanosome when a blood smear is fixed with osmic vapour, stained with Giemsa's stain, and mounted with Canada balsam. He claims that "the difference between the three forms is by no means one merely of size" and recognizes :—

(1) A slender form of great length and having a very long free flagellum.

(2) A stumpy form which is short, the flagellum of which is also very short, especially the free portion.

(3) The ordinary form more or less intermediate between the two extreme forms.

The human trypanosome which, although passed through animals in this laboratory has retained its morphological characteristics, exhibits in most cases specimens of the three types described by Minchin.

The *prevailing* type—of which the long and short forms appear to be derivatives—may be described as follows :—

Average total *length* 26—28 $\mu$.

Average *width* 1·7 to 2·25 $\mu$.

*Micro-nucleus* about 1·75 $\mu$ from posterior extremity.

*Posterior extremity* a truncated cone, the apex lying to the side of the median line.

*Macro-nucleus* longitudinal ovoid, 4 to 6 $\mu$ long, posterior edge about 7 $\mu$ from the posterior end of the parasite.

*Undulating membrane* well developed and highly festooned (five or more folds).

*Flagellum* fine with free portion about 7 $\mu$ long.

Some specimens show granules and in some there is an area which stains only faintly anterior to the micro-nucleus.

The *long* form has its posterior extremity drawn out into a "beak," its body is narrower, the macro-nucleus is elongated and the free flagellum may measure up to 12 $\mu$ or longer.

In the *short* forms the posterior extremity is shorter and the micro-nucleus may be terminal. The macro-nucleus is round or slightly oval and is situated centrally or slightly posterior to centre. The parasite is broader than the other types. The flagellum has little or no free portion.

Another type is frequently met with especially in animals about to die. It is of the long or medium type but stains faintly, the undulating membrane and flagellum being very inconspicuous.

*Subject*—Ewe (large brown fat-tail).

| Date | | |
|---|---|---|
| October 31, 1910 | 10 a.m. | Received intravenously 1 grm. atoxyl in aqueous solution. |
| ,, ,, ,, | 3.30 p.m. | Received subcutaneously 10 c.c. citrated blood of lamb No. 3 suffering from human trypanosomiasis. |
| November 1, 1910 | 12 a.m. | Received intravenously ½ grm. atoxyl. |
| ,, 2, ,, | | Received subcutaneously 5 c.c. citrated blood of lamb No. 3. |
| ,, 10, ,, | | 1 c.c. of this ewe's blood taken and injected at once into rabbit. |
| ,, 16, ,, | | Later. Received 1 grm. atoxyl. Above rabbit showing trypanosomes. |
| ,, 18, ,, | 5 p.m. | Above rabbit died. Blood containing 25 trypanosomes to the field. |
| ,, 21, ,, | | Sheep showing marked clinical symptoms. |

Parasites undergoing degeneration or division, or altered or distorted in the preparation or staining of the smear, frequently present unusual appearances

and may be seized upon as evidence of a new species. Too much importance should not be attached to such irregularities until various methods of technique have been employed to determine whether they are proper to the parasite or merely artefacts.

*Atoxyl Resistance.*—It has been stated that the trypanosome of Northern Rhodesia and Nyasaland is remarkably resistant to atoxyl, a contention which is brought out by the preceding experiment.

NOTE.—The strain recovered from lamb No. 3 has not been rendered atoxyl-resistant by artificial means, but has been shown by other experiments to be temporarily affected by the exhibition of the drug.

The experiment would appear to indicate that atoxyl is useless as a preventive against this trypanosome which can establish itself in a host previously saturated with the drug. Further, the parasite recovered from the treated animal appears to have increased in virulence.

*Trypan-blue.*—The trypanosome also appears highly resistant to trypan-blue as is shown by the following experiment:—

*Subject*—Ewe No. 5.
*Virus*—2 c.c. warm citrated blood from black ewe.
*Date*—August 29, 1910.
*Result*—Temperature and clinical symptoms showed infection. Trypanosomes also found in blood September 16, 1910, September 28, 1910, and October 7, 1910.
October 17—Animal apparently dying.
Blood taken and inoculated into Control rabbit No. 1.
Later. Received intravenously 100 c.c. of 1½ per cent. solution of trypan-blue.
October 18—Animal still very sick. Intensely stained.
1 c.c. blood taken from ewe and inoculated into Control rabbit No. 2.
Later. Received 10 c.c. of 10 per cent. solution of atoxyl intravenously.
October 21—4 c.c. blood taken (76 hours after injection of atoxyl and injected into Control rabbit No. 3.
October 29—Ewe died.

| Control Rabbit No. 1 | Control Rabbit No. 2 | Control Rabbit No. 3 |
|---|---|---|
| Oct. 22. Trypanosomes seen. | Oct. 22. Trypanosomes seen. | Nov. 26. Still alive. Trypanosomes never seen. |
| Oct. 26. Died after bleeding. | Nov. 1. Died. | |

*Post-mortem* examination of ewe showed well marked staining of the tissues with blue. The meninges were highly coloured *but the brain itself was not stained.*

Various methods of treatment, both with drugs and sera have been tried, but up to the present no successful results can be recorded. No case of natural recovery or immunity has been encountered; those animals which have appeared resistant or tolerant have eventually succumbed.

It has frequently happened that the exhibition of an agent of low parasitotropic but high organotropic properties, to an animal in which the disease is running a normal course, has brought about crisis. The use of drugs in unsuitable doses has produced similar results.

It may be mentioned that experiments have been conducted which have proved that the tissues of a fœtus of a highly infected mother are not infective; also that the milk of an infected ewe does not convey infection to the lamb feeding upon it, or to animals artificially inoculated with it. Lambs feeding upon such milk derive no immunity therefrom.

**"The Boston Medical and Surgical Journal," December 22, 1910.**

Guy Lane reports a case of bilharziasis. The patient, an old English soldier, had acquired the disease in South Africa at the time of the Boer War. He presented himself at hospital with symptoms of appendicitis. The organ was removed, and then it was discovered that bilharzial infection of the bladder existed as well. The patient recovered from the operation. The ova found in the appendix and bladder were of the terminal-spined variety. Infection of the appendix is a much more frequent occurrence than the author supposes.

**"Isthmian Canal Commission, Laboratory of the Board of Health, Department of Sanitation," 1910.**

Darling contributes some very interesting studies in relation to malaria in the Isthmian Canal Zone. Biting and infecting experiments, estimation of gametes, examinations for zygotes, and other work was carried out. *Cellia albimanus* would seem to be one of the chief carriers of the malarial parasites in that region. This is the old *albipes* of the West Indian Islands, which with the *C. argyrotarsis* is responsible for the dissemination of the disease in these parts. Besides these two, several other species of Anopheles are, however, found on the Isthmus; the life-histories and habits of these are well dealt with by Darling in his paper.

**"Journal of the Royal Army Medical Corps.," No. 1, January, 1910, vol. xvi.**

At the United Services Medical Society, Major Cummins read a paper on the prevalence of the Guinea-worm in the Sudan.

The parasite is apparently quite common there, the author having had no less than 25 admissions to the Khartoum hospital from a party of 69 men, who had spent the summer of 1905 in El Obeid. Again, at Rumbek, a station garrisoned by 20 irregulars, 14 cases occurred, and at one time a fifth of the corps of Jehedieh was unable to march from this cause. As regards treatment, Major Cummins believes that the method of gradual traction is better than the perchloride method, provided it is done with reasonable skill and with very thorough antiseptic precautions.

**"The Archives of Internal Medicine," vol. vi. No. 6, December 15, 1910.**

Brem, while serving during 1905 and 1906 in Dr. Gorgas' wards in Ancon Hospital, studied malaria with reference to the following points: (1) Incidence of malarial infections and mortality; (2) results of examinations of blood for malarial parasites; (3) the relative value of several systems of quinine administration; (4) the time of day when malarial paroxysms occurred; (5) malarial immunity; (6) the quinine test in differentiating malarial from other fevers; (7) chronic malaria or malaria cachexia.

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THE JOURNAL OF

# Tropical Medicine and Hygiene

JANUARY 16, 1911.


## THE HUMAN TRYPANOSOME OF NORTHERN RHODESIA.

THE occurrence of cases of human trypanosomiasis in Nyasaland and Northern Rhodesia in the absence of the fly *Glossina palpalis* has led to many suggestions which might explain this apparent anomaly. Dr. Bagshawe dealt with the matter in the "Bulletin of the Sleeping Sickness Bureau" for June, 1910, and following that, Dr. Low, in the JOURNAL OF TROPICAL MEDICINE AND HYGIENE for July 15, 1910, suggested that the trypanosomes in these cases might belong to a different species than the *Trypanosoma gambiense*. He thought that the time had come to keep such an eventuality in mind, and that it should be shown where possible whether the parasites were *gambiense* or not. Already Dr. Stephens, of the Liverpool School of Tropical Medicine, had noted a marked peculiarity in the morphology of a trypanosome derived from a Rhodesian case under the care of Professor Ross in the Royal Southern Hospital, Liverpool, and following this up in conjunction with Dr. Fantham, he read a paper on the subject before the Royal Society on November 3, 1910. In the *Annals of Tropical Medicine and Parasitology* for December, 1910, the same authors republish their paper, which is entitled, "On the Peculiar Morphology of a Trypanosome from a Case of Sleeping Sickness, and the Possibility of its being a New Species, *T. rhodesiense*." The chief peculiarity of this Rhodesian trypanosome is that among the stout or stumpy forms some had the nucleus at the posterior (non-flagellar) end. Such forms, the authors state, have not, as far as they are aware, been described, either in the blood of sleeping sickness patients or in the blood of animals infected with *T. gambiense* before, and they therefore rightly consider that this peculiar morphological fact alone is strong evidence of the trypanosome being a new species.

Dr. Yorke's work on the inoculation of the parasite into animals also supports this contention, his results showing that in so far as virulence is concerned the parasite is widely different from *T. gambiense*, and much more resembles the results obtained by the inoculation of *T. brucei*. In to-day's issue of the Journal readers will find a paper by Castellani, referring to his old idea of the plurality of species of human trypansomes; and also one by Mr. Bevan, in which he narrates his experiences of inoculations of animals with a trypanosome recovered from another of the cases of Rhodesian human trypanosomiasis.

His results are very interesting, especially when compared with Dr. Yorke's mentioned above. Mr. Bevan found that the domestic animals were readily susceptible to this individual trypanosome, and that the inoculation gave rise in them to symptoms no less severe than those caused by infection with the animal trypanosomes.

From an examination of charts of sub-inoculated animals, he concludes that the strain is one of exceptional virulence; an observation which coincides with the experience of medical officers studying the disease in human subjects in the field. An increase of virulence in a trypanosome does not necessarily mean that it is a new species—it might only be *T. gambiense* introduced into new soil; but this, taken in conjunction with Drs. Stephens, and Fantham's paper, and more recently with Dr. Stannus's statement, that doubt is now being entertained by medical men in Nyasaland of the identity of the pathogenic trypanosomes in the late Nyasaland cases with the *T. gambiense*, is undoubtedly suggestive and urgently calls for more work on the subject. The recent report by Dr. Stannus would seem to definitely prove that the Nyasaland and North Rhodesian cases have arisen without the intervention of *Glossina palpalis*, and the whole subject of human trypanosomiasis—a subject which seemed to be finally settled some years ago—will have to be reopened and worked at afresh. We are evidently only on the threshold of some new and very important discoveries in this interesting subject.

## PLAGUE INVESTIGATIONS IN INDIA.

A FURTHER report on the investigations of plague in India has just been issued by the Advisory Committee appointed by the Secretary of State for India, the Royal Society, and the Lister Institute. The *Journal of Hygiene* publishes the report, devoting a fifth extra number to the material in question. Some very useful work has been accomplished since the previous report appeared, and the Advisory Committee

now publish the chief conclusions which have been provisionally reached by them as a result of the investigations made under their direction from 1905 to 1909. Some of these conclusions are specially important, in view of subsequent attempts to diminish the disease; and, such being the case, they should be widely disseminated, so that all who run may read. Considerable epidemics of human plague, the Committee believe, consist almost entirely of cases of bubonic plague, and are directly dependent on the occurrence of epidemic plague in rats. The development of the rat epidemic precedes the human epidemic by about a fortnight. Though rats may be infected by feeding upon the bodies of other rats dead of plague, yet in Nature the disease is almost entirely, if not always, spread among rats by the agency of rat fleas. Again, the Committee are of the opinion that in the great majority of cases, during an epidemic of plague, man contracts the disease from plague-infected rats through the agency of plague-infected rat-fleas. Bubonic plague is not, they think, directly infectious from man to man, and they quote in support of this the experience of plague hospitals where there is no tendency for the disease to spread from the sick to the attendants.

Though everyone will agree with this, yet at the same time it is well to remember that there have been epidemics of pneumonic plague—for example, on the Gold Coast recently—and the danger of coming into contact with such cases cannot be too strongly impressed upon all. Why cases originally acquired from the rat in the ordinary way by its flea should take on this pneumonic type, and so enable the germ to pass directly from man to man, is not well known, and further study should be directed to the solution of this problem. The same must also unfortunately be said of the seasonal recurrence and spread of plague. Why the disease should disappear during the non-epidemic season, only to reappear again in the epidemic season, has never been satisfactorily explained. Even granting the contention of the Committee that plague appears to be commonly imported into a fresh locality about the persons of human beings, if bubonic, why should it spread either to rat or man? Such problems as these require explanation; but even though this is so, yet the work accomplished up to date by the workers acting under the Advisory Committee is excellent, and should help considerably in any further campaigns against the spread of this deadly disease in India and other parts of the world.

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Value of Inoculation against Plague.—During the recent outbreak in Nagpur city, Central Provinces, India, of 22,347 persons inoculated against plague, 45 contracted plague and 24 died; whereas amongst 105,387 persons not inoculated, there were 7,859 cases and 7,269 deaths; in other words, the percentage of fatal cases of inoculated stood to the uninoculated as 0·2 to 7·4. Of the staff of 111 persons employed by the Bombay Bacteriological Laboratory in killing rats, no one contracted plague. The secret of this immunity is ascribed to the fact that the whole staff are inoculated once every year.

# Abstracts.

## HOOK-WORM INFECTION AND DISEASE IN NATAL.

By Burton Nicol.

*Medical Superintendent, Indian Immigration Trust Board of Natal.*

*The Recorded History of the Subject in South Africa.*—Dr. Mathias, of Kimberley, first called attention to the presence of hook-worms in South Africa. This was in 1896. Dr. Posnett,[1] of Johannesburg, in 1906, reported finding the ova of hook-worms in 32 per cent. of cases examined at Johannesburg Hospital. In 1908 Dr. Turner reported the result of 746 *post-mortem* examinations in which intestinal parasites, particularly hook-worms, were looked for. Dr. Turner found the parasite in 47·05 per cent. of the bodies examined. It was present in 55·48 per cent. of new arrivals and in 32·35 per cent. of those who had been working for some time on the mines.

In 1904, Dr. Dennington Fisher reported the first death from ankylostomiasis in Natal. In 1905 Dr. Bonfa, of Tongaat, drew the attention of the Health Officer of the Colony to the presence of these parasites on a sugar estate in his district. In 1906 Dr. Park Ross was specially engaged to deal with an outbreak of hook-worm disease in the Tongaat Circle. Of 1,587 Indian immigrants examined, 820, or 51·6 per cent., contained the ova of hook-worms; 838, or 52·8 per cent., contained the ova of round-worms; 250, or 15·7 per cent., the ova of whip-worms; and 50, or 3·1 per cent., the ova of tape-worms. In every case the individual was in good health; no hospital cases are included in the figures.

Of 71 natives of Natal hook-worm ova were found in 11; *ascaris* ova in 11; *Trich. dispar* ova in 17; *tænia* ova in 18.

*Results of Treatment.*—Beta naphthol in doses of 25 gr. for women and 30 gr. for men gave the best results. Our system of treatment was to give on the evening preceding, 4 drachms of sulphate of magnesia. On the following morning we gave:—

At 6 a.m., 30 gr. of beta naphthol.
At 8 a.m., 30 gr. ditto.
At 10 a.m., 30 gr. ditto, and
At noon, 6 drachms of sulphate of magnesia.

We found it convenient to give the beta naphthol in the form of a mixture which contained 5 grains of the drug in each fluid drachm.

*The species of hook-worm present in Madras Indians* was proved to be the *Necator americanus*.

*Incubation Period of Necator americanus.*—One experiment was made to ascertain the period of incubation. A portion of a culture eight days old was placed in contact with the skin of an adult male for half an hour. A most irritating vesicular eruption was quickly produced. The pruritus was almost unbearable for twenty-four hours, and lasted altogether for about six days. The rash lasted altogether for twice this period, disappearing very gradually. Ova were found in the stools sixty-four days later. Previous experience has given the following results:—

[1] *Lancet*, September, 1906.

| | | | | |
|---|---|---|---|---|
| Boycott | found eggs in the stools | | 50 days | after infection. |
| C. A. Smith | ,, | ,, | 45 | ,, |
| Looss | ,, | ,, | 70 | ,, |
| Pieri | ,, | ,, | 71 | ,, |

A study of the literature of the subject inevitably leads to the conclusion that the production of disease by the hook-worm depends entirely upon the numbers in which they may be present in the human intestine. The evidence seems to be overwhelming that until they are present in sufficient numbers to overcome the large reserve of blood-forming power with which Nature has endowed man, there can be no anæmia or debility, and that the classical group of symptoms which has been variously called ankylostomiasis, uncinariasis, or hook-worm disease, will be absent.

It is certain that Natal is not afflicted with endemic hook-worm disease. The reason for this statement is the almost complete absence of proved cases found during an investigation that has lasted in all for three years, and the diminution that takes place in the number of hook-worm carriers among indentured Indians during their period of residence in Natal.

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## THE DISCUSSION ON THE DISTRIBUTION AND PREVALENCE OF YELLOW FEVER IN WEST AFRICA AT THE SOCIETY OF TROPICAL MEDICINE AND HYGIENE.

*(Continued.)*

Dr. C. F. Harford said that Sir Rubert Boyce was to be congratulated upon introducing to the notice of the Society a matter of the greatest practical importance, and whether the Society agreed or disagreed with his conclusions, the subject was one worthy of most serious attention. It should be remembered that the discussion was not of mere academic interest, but had become of particular urgency, owing to the recent outbreak of yellow fever in West Africa, which had led to the loss of valuable lives.

There was some danger lest the suggestion of blame, which might be attributed in the past to medical practitioners working in West Africa, should obscure the main points at issue, but in Dr. Harford's opinion the facts of the case might be explained without attributing to the medical profession on the coast either an attempt to conceal unpalatable truths, or ignorance in diagnosis; and until this was definitely proved, it was only just to give them the benefit of the doubt. When it was remembered that there is no absolute scientific test of the diagnosis of yellow fever, there was every excuse for failure to recognize the disease when it was not believed to be endemic.

Dr. Harford then recalled the facts which Sir Rubert had put before the Society. Well-recognized outbreaks of yellow fever had occurred every few years in West Africa, whilst other epidemics, which were probably of the same nature, had occurred more frequently. No evidence was available to indicate that these epidemics had arisen as a result of infection brought from any of the well-known yellow fever centres; yet, unless this could be proved, there remained only the conclusion that the disease must be endemic in West Africa. Sir Rubert pointed out that there were a number of titles given to fevers acquired in West Africa, the true nature of which was distinctly doubtful; and in particular he instanced that which was the most unsatisfactory of all, the so-called bilious remittent fever. The only evidence which Dr. Harford could bring forward related to an epidemic which took place at Lagos in January, 1894, in which six missionaries died within the month, as well as other Europeans, and in which other missionaries were also ill. The facts were as follows:—

A party of missionaries arrived in Lagos on December 13, 1893. Some of them were going to the Lagos Hinterland, some to Lagos itself, but the majority were only staying in Lagos, *en route* for the Niger. They all seem to have arrived at Lagos in good health, and those who proceeded up country remained well, but most of the others, together with some of the missionaries already resident in Lagos, were taken ill, and of this number six died within the month of January. There seems to have been a good deal of exceptional illness even outside missionary circles, and the harbour master, Captain S., is said to have died of "hæmaturic fever." On January 1 it was reported that the Rev. F. G. T., a missionary who had been resident in Lagos, had been ill for several days with "fever," but the symptoms were evidently slight, and on that day the cases of serious illness commenced.

Bishop Hill, aged 42, taken ill January 1.—Tuesday, January 2, 1894, Dr. Rome Hall said he was not alarmed at the fever, but at the state of his heart, stating that his "quick breathing indicated great weakness of heart." He found also enlargement of the spleen.

January 3.—Grave anxiety during the day about Bishop Hill, mainly on account of the stupor in which he lay and the weak action of the heart. Began to perspire 4 p.m., and since then has slept quietly.

January 4.—Bishop Hill very ill all day with retching and vomiting. Hæmaturia said to have set in—a violent attack of hiccough early in the morning, followed by other attacks during the day. Delirious during the evening, endeavouring to get out of bed.

January 5.—Bishop Hill died at 4.35 p.m. He lay tossing all the previous night, rapidly losing strength as one attack of hiccough followed another. He did not regain consciousness.

Mrs. Hill.—Taken ill on January 2, reported to be vomiting badly.

January 5.—Mrs. Hill died at midnight, having been unconscious for two days.

Miss M., aged 41, fully trained hospital nurse, a member of Bishop Hill's party, taken ill on January 1 with fever. This case was not so serious as the others, but the patient had to be invalided home, and the medical certificate read as follows: Anæmia, dropsy, tropical fever, with temperature up to 103° F., followed by prostration, with pulse-rate ranging from 50 to 55 a minute, and metrorrhagia."

Rev. J. V.—A missionary residing in Lagos.

January 13.—Stated to be far from well.

January 15.—Started with fever. 4 p.m., temperature 103° F.

January 16.—Temperature still 103°, vomiting and straining a good deal.

January 17.—Temperature 101°, having had a restless night and retching constantly.

January 18.—Temperature lower, but still very restless. 10 p.m., distinctly worse.

January 19.—Somewhat better, but only able to take nourishment by enema.

January 20.—Worse in the early morning, vomiting, unconscious soon after, and died at 11 a.m.

Miss M. aged 24.—One of Bishop Hill's party. Taken ill with fever January 17. Temperature 102·5° F. Fever appears to have continued, and on January 21 was reported to be very weak and greatly depressed. January 22 she was said to be better, but at midnight sudden collapse set in and she died.

Rev. E. W. M., aged 24.—One of Bishop Hill's party. Taken ill on Sunday evening, January 14, on board ship in the Forcados River. January 15, early in the morning the temperature was 103° F., and never after that fell below 100°. January 17, is stated to have developed pneumonia, with very rapid breathing, and repeated attacks of hiccough. At 4.30 his temperature was 103°, and he became delirious, and struggled violently, managing to get out of bed. During the struggle he brought up a mouthful of blood, and vomited mouthfuls of blood several times afterwards. By this time his temperature was 105°, and he was put in a wet pack, but without any effect on the temperature, and at 6 o'clock he died. His death was certified by the doctor as due to malarial fever.

Rev. A. E. S.—Taken ill with high temperature on January 3, at Lagos. Does not seem to have been seriously ill, and was well enough to leave Lagos for the Niger with two fellow-missionaries on January 14. Was taken ill on January 15, but was not so seriously ill as the previous case. He, however, rapidly became worse, and died on board ship on January 21.

This again was certified by the doctor as a case of "malarial fever," but it was recorded that those on board ship were much struck by the peculiarly malignant type of fever in each case. No rallying ever took place.

There could be little doubt in the minds of anyone who considered these cases, Dr. Harford thought, that the epidemic was not malarial fever, and no other fever that we knew would fit in with the circumstances of the case, except yellow fever. It remained, therefore, to consider how the epidemic started. It could not have been brought by the party who arrived on December 13, since the first date on which any of the party were taken ill was January 1, and it is clear that there had been illness in Lagos of a serious character previous to their arrival. It was also remarkable that those who had not remained in Lagos, but who immediately went up country, entirely escaped the epidemic. It was probably local. Bishop Hill's party suffered so severely because they had recently arrived from England, and they had no chance of being immunized in any way, and had it not been for this fact and the heavy mortality no suggestion would probably ever have been made that this was an outbreak of yellow fever, and it is only in looking back and carefully studying the facts that one was led to the diagnosis in this instance.

Dr. Harford was inclined, he said, to support the view which had been expressed by Sir Rubert Boyce, though he considered that it would be a great mistake to put down all uncertain cases of fever as yellow fever, as it had been in the past to class these as malarial fevers.

## LONDON SCHOOL OF TROPICAL MEDICINE.

### Examination Result (Thirty-fourth Session, October to December, 1910).

Allan, K. B., M.B., B.S.Durham (Colonial Service).
*Anderson, Captain W. M., I.M.S., M.D., B.S.Lond.
Barrie, H. G., M.D., C.M.Trin.
*Beit, Captain F. V. O., I.M.S., M.B.Lond.
Booth, L. H., M.R.C.S., L.R.C.P. (Colonial Service).
*Brooks, R. St. John, M.B., B.Ch.Dub., D.P.H.Dub.
Cotton, Miss N. G., M.B., B.S.Lond.
*Donnelly, J., M.B.Irel. (Colonial Service).
*Gilbert, Captain L. E., I.M.S., M.B., B.S.Lond.
Kahn, Miss I., M.D.Michigan.
*Keates, Captain H. C., I.M.S., M.B., B.S.Lond.
*Lane, Major C. A., I.M.S., M.D.Lond.
*Murray, Captain J. H., I.M.S., M.B., M.R.C.S., L.R.C.P., D.P.H.
Rollason, G., L M.S.S.A. (Colonial Service).
Roper, R. S., F.R.C.S.Edin., M.R.C.S., L.R.C.P.
Ryan, W. A., L.R.C.P., L.R.C.S.Irel. (Colonial Service).
Smith, A. J., M.B.Birmingham (Colonial Service).
Thompson, C. S., M.B., B.S.Durham (Colonial Service).
Ward, J. F. W., L.R.C.P. & S.Edin. (Colonial Service).
*Watt, W. G., M.B., Ch.B.Aberd. (Colonial Service).
*Webb, Captain H. G. Stiles, I.M.S., L.R.C.P., M.R.C.S., D.P.H.
Wills, F. T., M.B., C.M.Edin.

## THE UNIVERSITY OF LIVERPOOL.

### Examination Lists, December, 1910.

### Faculty of Medicine.

*Diploma in Tropical Medicine.*

E. Brabazon, M.R.C.S., L.R.C.P.
L. Castellino, L.M.S.
J. A. Caulcrick, M.B.
W. E. Haigh, M.R.C.S., L.R.C.P.
H. F. Hamilton, M.B., Ch.B.
W. St. M. Hefferman, C.M.S.
A. Hipwell, L.R.C.P. & S.I.
J. Homer, L.M.S.
W. M. Houston, M.B., Ch.B.
D. P. Johnstone, L.R.C.P. & S., L.F.P.S.
A. G. Macdonald, M.B., C.M.
C. C. Murison, F.R.C.S.E.
P. D. Oakley, M.R.C.S., L.R.C.P.
I. C. Pratt, L.R.C.P. & S., L.F.P.S.
E. L. Sieger, M.B., Ch.B.
P. J. de Sousa, L.M.S.
J. H. Waterhouse, M.B., B.Ch.

* With distinction.

## Drugs and Appliances.

OPPENHEIMER, SON AND Co., 179, Queen Victoria Street, London, E.C., have introduced *Acetosal* a purified amorphous form of acetylsalicylic acid administered in palatinoids. It is an effective anti-rheumatic, antipyretic and analgesic, possessing all the therapeutic advantages of salicylic acid or the salicylates, but without their disadvantages.

*Linimentum Analgesic*, containing methyl salicylate, menthol and essential oil of camphor rubbed into parts affected by rheumatism affords speedy relief.

*Iodsam*, a chemical combination of iodine with olein, is calculated to lessen the chances of iodism and to be more effective than iodide of potassium.

*Roboleine*, a combination of fresh bone-marrow, the expressed juice of calves' rib bones, cream of malt and the hypophosphites of lime, soda and potash, presents many advantages as a restorative and tonic.

*Pulverettes of Quinine* will recommend themselves to all practitioners in the Tropics.

The simplicity of the method of making up the ingredients into pulverettes is a great feature of this method of administering quinine. The powders are merely moulded into shape, covered with a thin coating of albumin, to hold the powder together, and then they are coated with either chocolate or with sugar, keratin, or any other coating material that may be desired.

*Pulticine* has been introduced as a substitute for the usual method of applying moist heat, such as hot fomentations and poultices; pulticine can be used in all cases for which these older methods of relief were employed. Pulticine is supplied in jars. To apply, stand the jar in hot water until warm, then spread on the affected part and cover with cotton-wool.

MESSRS. BURROUGHS WELLCOME AND Co.—Several interesting booklets have been issued by Messrs. Burroughs Wellcome in connection with the Japanese Exhibition in London and the Brussels Exhibition. The attractiveness of the cases, in which the preparations and products of the firm were shown at both Exhibitions, was testified by the public interest they created. The "Tabloid" Brand Medicinal Chests, facsimiles of which have done excellent service as part of the outfit of many travellers and of sportsmen in big game expeditions, are ideal specimens of compactness and completeness. The chest weighs 40 lb. only and can be packed on horse or mule back, or carried by natives on their heads. An attractive feature of the publication is the illustrations of the Wellcome materia medica farm in Kent, where many important drugs are grown and the preparations made from the home-grown plants. Hyoscyamus, belladonna, aconite, hydrastis, and many other medicinal plants are to be seen growing on the farm, to the great advantage of the pharmaceutical profession in which they take part. The Physiological Research Laboratories at Herne Hill, London, are well worth a visit. Amongst the most interesting of the laboratory products are the endotoxins and anti-endotoxins. Endotoxin is the name given to the toxin contained within micro-organisms in contradistinction to toxins obtained in culture filtrates. Various methods of obtaining endotoxins have been used, but the best is probably that devised by Mcfadyen and Rowland. They found that organisms when subjected to a very low temperature, such as that of liquid air, still retain their vitality, so that, when again brought to the normal temperature, they are found not to have suffered in any essential respect. At this low temperature the organisms, being in a brittle condition, are readily broken up by grinding. Extracts from this material are obtained in dilute solution of caustic alkali. An elaborate grinding apparatus was devised by Mcfadyen and Rowland for this purpose. The juice so obtained is filtered through a Berkefeld filter to remove the uninjured organisms. The quantity of dissolved material is approximately shown by the amount of precipitate obtained on acidulating with acetic acid.

Anti-endotoxins are obtained by injections of endotoxins into animals in a similar manner to that used for other anti-sera. Mcfadyen, in the case of typhoid, claimed to have prepared, by this means, a very much stronger anti-serum than has been found possible by the injection of the intact organisms. He also prepared an anti-endotoxic cholera serum by injecting goats intravenously. His results show a very high degree of both antitoxic and bactericidal power in the sera so obtained.

MESSRS. ALLEN AND HANBURY'S, LTD., 7 Vere Street, Cavendish Square, London, W., have prepared, under the name of *Iodolysin*, an improved method of administering thiosinamin and organically combined iodine as absorbente. Iodolysin is used for the removal of scars and all forms of pathological fibrous tissue, for chronic arthritis, deafness, arteriosclerosis, pleuritic adhesions, fibrosis of lung and cirrhosis of the liver. The drug may be exhibited hypodermically by the mouth as a "kapsol," and by local application as a pigment and ointment. For hypodermic injection iodolysin is put in "azoule" form, *i.e.*, sealed glass capsules in 15-minim and 30-minim quantities.

MESSRS. PARKE, DAVIS AND Co. have issued a fourth edition of their pamphlet on Serum Therapeutics. For tropical practitioners the following items in the report will be welcomed. Referring to the keeping power of the anti-diphtheritic serum, it has been ascertained by repeated experiments that the serum loses none of its curative qualities by being kept even for a year. In the event, therefore, of a practitioner in the Tropics having no fresh serum, he can use the old serum; practically it would be well were he to get a small supply sent him every six months, so that fairly fresh serum is always at hand; for, as a rule, in remote districts, it may be a month or more before fresh serum can be obtained.

Dry anti-diphtheritic serum appears to retain its potency indefinitely, it is made ready for use by the addition of sterile distilled water.

All sera should be sent in soldered tins to the Tropics, for in this way, and in this way only, can potency on arrival after a long voyage be insured. Medical men should refuse to accept any preparations of the kind not sent in soldered tins. The so-called

"air-tight" packages are useless to stand the vagaries of a sea-voyage climate. Cancrum oris is reported to have been successfully treated by anti-diphtheritic serum; this is an important therapeutic adjunct in countries where cancrum oris occurs in even mild epidemic forms, and the possible association between cancrum oris and Oriental sore opens a field of treatment for Oriental sore which might bear fruit.

TETANUS NEONATORUM, the scourge of so many convent and hospital-born children in the Tropics, has been found to yield to antitetanic serum.

DEWEY and PUTNAM report a case of tetanus neonatorum, in which 10 c.c. of "P., D. and Co." antitetanus serum were injected on each of three successive days over the sciatic nerve at the gluteal fold, whilst chloral and potassium bromide were given per rectum. On the fourth day, 10 c.c. of serum were injected morning and evening into the spinal cord, and on the fifth and sixth days one such injection was given. From that time recovery proceeded steadily, and on the eighth day rigidity of the back and lower extremities had disappeared.

ANTITETANIC DUSTING POWDER, a mixture of equal parts of dried antitetanus serum and chloretone, should be applied to the navel of newly-born children in convents and hospitals in tropical countries. It should be remembered also that a nurse, resident in one of these convents which frequently supply monthly nurses, especially amongst Roman Catholic communities, is apt to infect children in private houses with tetanus neonatorum. In such cases the use of antitetanic dusting powder should be made compulsory.

MESSRS. MARTINDALE, 10, New Cavendish Street, London, W., draw attention to many interesting products of which the following will interest tropical practitioners: (*a*) Capsules of sodium oleate compound—an antiseptic cholagogue useful in gall-stones and in cases of inspissated bile; (*b*) charta hydrarg. bichlor. Slips of blotting paper impregnated with perchloride, a convenient plan of carrying antiseptic for preparation of lotions; (*c*) formagules—gelatine capsules rendered more likely to dissolve in the intestine than in the stomach. The capsules may be filled with any substance intended to act upon the intestinal tract; (*d*) mistura belladonna xanthoxyli et hyoscyami—for use in morphinism, cocainism and alcoholism; (*e*) tablets of Warburg's tincture without aloes—for malaria, hepatitis, &c.; (*f*) "trilactine" tablets, intestinal in "stearettes" *i.e.*, so coated as to dissolve in the intestines rather than in the stomach; (*g*) Wassermann's test outfit.

MESSRS. KALE AND CO. draw attention to the following preparations: Biebrich scarlet R., used with 4 to 8 per cent. vaseline or olive oil as an ointment in extensive injuries to the skin, as in burns, abrasions, &c. *Bioferrin*, a blood-forming organic iron preparation. *Bismon* and bismuthose, mild intestinal astringents. *Dormiol*, a hypnotic. *Nastin*, for leprosy. *Neuronal*, sedative. *Orexin*, a stomachic.

C. J. HEWLETT AND SON, LTD., 35 and 42, Charlotte Street, London, E.C., announces the following preparations:—

(*a*) "Coneuro (mist. Neuro Co., Hewlett's)."—Contains in each drachm quinine, tr. nux vom., caffein, phenazonum, tr. gelsem., pot. brom., and elixir aurant. It has marked antipyretic properties; an efficient remedy in neuralgia, neuritis, &c.

(*b*) "Elixir Theocin Co. (Hewlett's)."—Contains 2 gr. of theocin sodium acetate and 2½ minims of physio-tinct. digitalis in each fluid drachm. In the dropsy of cardiac diseases and chronic renal affections.

(*c*) "Evapogens (Hewlett's Evaporating Skin Lotions)."

(*d*) "Hæmorrhaline." Containing acetate of lead, distilled witch hazel, morphine with lanoline. Specially recommended for the treatment of hæmorrhoids.

(*e*) "Iodermiol." A useful and non-irritating preparation of iodine for external application.

(*f*) "Laxans." Compressed tablets of phenolphthalein, prepared in three strengths—mild, medium, and strong.

(*g*) "Lin. Betulæ Co. (Hewlett's)." A combination of oil of sweet birch, consisting principally of methyl-salicylate, with menthol, camphor, &c., which has proved most beneficial in the external treatment of acute and chronic rheumatism, sciatica, lumbago, synovitis, &c.

(*h*) "Mist. Heroin et Thymi Co. (Hewlett's)." For advanced bronchitis and chronic irritable cough.

TROPACOCAINE (Benzoyl-pseudo-tropeine) has been introduced by E. Merck, 16, Jewry Street, London, E.C., as the most suitable remedy for lumbar anæsthesia.

FIBROLYSIN (in an epitome of recent knowledge concerning fibrolysin issued by E. Merck, 16 Jewry Street, London, E.C.) is now being tried in Dupuytren's contraction, otology and rhinology, gastric adhesions, strictures of the digestive tracts, abdominal adhesions, burns, urinary diseases, ophthalmology, gynæcology, diseases of the lung, locomotor ataxia, heart disease and arterio-sclerosis, interstitial hepatitis, neuritis and neuralgia, and chronic arthritis and ankylosis.

WARRICK BROS., LTD., 6, Nile Street, City Road, London, N., issue many useful drugs in common use in the Tropics in oval-shaped form (Flexoids) or in round, flat shapes (Pulvellæ). The preparations of quinine sulph., of quin. sulph. acid., of quinine in combination with gelsemin and ergot and cannabis ind., of quin. hydrobrom., of quin. salicylate, and of quin. valerianate, are convenient and readily digestible; "chocellæ" are small lozenges appropriate for giving medicine to children.

MESSRS. COXETER AND SON, London, are the sole makers of the Coxeter carbon dioxide snow apparatus. Carbon dioxide has attained so great a reputation as the means of treating nævi and other cutaneous blemishes, and is so simple of application that every practitioner will desire to possess the apparatus.

## Annotations.

Orton and Dodd, in the *Boston Medical and Surgical Journal* for December 8, 1910, contribute a paper on "The Transmission of Bacteria by Flies, with Special Relation to an Epidemic of Bacillary Dysentery at the Worcester State Hospital, Massachusetts, 1910." They found an organism conforming to the Shiga type of the *Bacillus dysenteriæ* in ten out of fifteen cases. For detecting the part flies play in the spread of bacteria, they planted *B. prodigiosus* in the laundry where flies could get access to the cultures. Later on, this germ was recovered from flies caught in the scullery and five screened ward dining rooms at an interval of from two to six days after the original plant. From these and other experiments they conclude that it is impracticable in most insane hospitals to keep the flies from access to fæcal matter, and from food, when they are present outside in large numbers; and, therefore, the best prophylaxis against fly-borne epidemics is cleaning up the breeding places of the fly to reduce its numbers or to eradicate it. They believe that in hospitals surrounded by considerable ground it is probable that the great majority of the flies are home-grown, and, therefore, that their breeding places should be carefully sought for and destroyed.

*Sleeping Sickness.*—Dr. Stannus, in the "Nyasaland Protectorate Sleeping Sickness Diary," part xii., gives a synopsis of Mr. Neave's report on his recent journey to the Luangwa valley. Mr. Neave followed the Luwumbu river from Katumbi to its junction with the Luangwa, keeping to the left bank as far as the Mwilesi, and then to the right for a further thirty miles. He then left the river and proceeded west to the Niamadzi river, in the valley of which three cases of sleeping sickness were recently discovered by Dr. Leach. There were no signs of *Glossina palpalis* or *G. fusca* on these rivers, including the neighbourhood of Nawalia, though the country was not altogether unsuitable for the latter species. Mr. Neave believes that the country visited was unsuitable for *G. palpalis*. *G. morsitans*, on the other hand, teemed on both sides of the valley southwards from a point at the junction of the Luwumbu river, and its spread during the last five years is remarked upon, though natives state that this recent spread is only recovery of ground lost at the time of the rinderpest fourteen years ago. *G. fusca* was found on the tributary, streams of the Luangwa rather than on the main stream, specimens being taken on the Chimanyama stream at the point where the main road crosses it, and on the Kanga stream also at the crossing of the main road. Mr. Neave thinks that possibly they might be found in small numbers on all the tributaries, and also on the banks of the main stream, during the rains. In his conclusions he states that there is considerable justification for excluding *G. palpalis* as the cause of the cases of sleeping sickness in the Luangwa valley.

*The Treatment of Cholera.*—In the *Indian Medical Gazette* for December, 1910 (p. 497), Captain Rutherfoord, I.M.S., contributes the notes of a series of cases of cholera treated by Major Leonard Rogers' method of infusion of hypertonic saline solution. The results obtained lead Captain Rutherfoord to believe that this line of treatment is the rational and hopeful method of treating cholera. For success, however, the operation should be performed early, the sooner after the establishment of the diagnosis the better. Even when the pulse is fairly good, Captain Rutherfoord thinks the infusion must aid in washing out toxins through the kidneys. To wait until the blood-pressure has fallen and the specific gravity of the blood has risen seems to him to be about as rational as to wait for the development of an abscess to operate on a case of appendicitis, or until the larynx is nearly blocked with membrane before giving antitoxin in diphtheria.

*The Ipecacuanha Treatment of Dysentery and Hepatitis.* — Lieutenant-Colonel Pilgrim, I.M.S., recently opened a discussion before the Medical Section of the Asiatic Society of Bengal on the treatment of dysentery and hepatitis by ipecacuanha. Major Rogers, it will be remembered, recently strongly advocated the pressing of ipecacuanha, where hepatitis or the suspicion of an abscess starting in the liver were present, and now Lieutenant-Colonel Pilgrim and others bring forward evidence in favour of this line of treatment. Captain Greig, for example, found that the effect of administering full doses of ipecacuanha in early cases of amœbic hepatitis was to produce a fall in the temperature and leucocytosis with disappearance of the subjective symptoms. Lieutenant-Colonel Knott, though extremely sceptical of ipecacuanha at first, gave it a fair trial, however, and now he is absolutely convinced of its value in every case of amœbic hepatitis. Other speakers spoke in a similar strain, and there is no doubt that the revival of the ipecacuanha treatment for amœbic hepatitis, amœbic dysentery, and the presuppurative stages of amœbic abscess of the liver is a sound one, and the best that the present can give us.

How the drug fell into disfavour was very probably due to its adoption for all forms of dysentery, bacillary included, and so unfavourable results appeared.

Further, unless the drug is given in large and adequate doses, continued over proper periods of time, similar failures will be got; used correctly, however, it will be found, as just said, to be of the greatest value.

## Notes and News.

Naval Medical Distinctions. — The Sir Gilbert Blane Gold Medals which are conferred every two years on two medical officers of the Royal Navy for "distinguished proofs of skill, diligence, humanity, and learning, in the exercise of their professional duties," have been awarded to Fleet-Surgeon George Trevor Collingwood, M.V.O., of his Majesty's ship *Racer*, and to Fleet-Surgeon Arthur Reginald Bankart, M.V.O., M.B., of his Majesty's yacht *Victoria* and *Albert*. The adjudicators are the

presidents of the Royal Colleges of Physicians and Surgeons of England and the Director-General of the Medical Department of the Royal Navy.

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Messrs. Burroughs Wellcome and Co.—The "Wellcome Photographic Exposure Record and Diary" for 1911 is artistic in design, a perfect treasury of information, and an indispensable companion for any one and every one engaged in photography. Amateurs who use one particular film or plate will find a special slip for attachment to the disc, which indicates the correct exposure for every stop. This attachment is supplied gratis (on application) to purchasers of the book by the publishers.

Another new feature of this year's edition is the special article on "Colour Photography," in which a simplified method of producing the necessary solutions is given.

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For the convenience of its world-wide readers and users, the "Wellcome Exposure Record and Diary" is published in three editions, namely, "The Northern Hemisphere and Tropics," "The Southern Hemisphere and Tropics," and "The United States of America."

When purchasing, care should be taken to specify which edition is required.

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The Clayton Disinfecting System has been so long and so favourably known and adopted in almost every country that it is to be hoped the local authorities in England, more especially in the districts immediately threatened by plague, will see that Clayton's method of dealing with the destruction of rats and insects holds a prominent place. Every one who has seen the Clayton disinfecting system at work must allow that it has no superior as a means of not only destroying rats, fleas, and parasites, but also in connection with the sterilization of the plague germ itself, as pointed out in Dr. Wade's Report to the Local Government Board, and also as mentioned by Professor Simpson in his "Treatise on Plague."

For ships, for dwelling-houses, out-houses, barns, and school-rooms, the Clayton apparatus is equally applicable and efficacious.

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*The Polyclinic.*—Appreciative evidence of the good work done at the Polyclinic, London, appeared in the *British Medical Journal* in a letter from Drs. J. Whitton (Oamaru, New Zealand) and T. A. Newell (Lyttelton, New Zealand). Their letter was as follows:—

"We have just finished six months' post-graduate work in London, and have completed the courses at the Polyclinic in Chenies Street. We should like to make known through your paper, for the benefit of Colonial men coming to London, the high value of the classes there, and the helpfulness and kindnesses of the teachers one and all. Everything in their power is done to assist students, both with lectures and clinical work."

We heartily endorse this opinion of the Polyclinic. Every medical man coming from abroad would do well to enter his name at the Polyclinic, where he can, for the modest fee of £1 1s., have the privilege of using the reading room, library and public rooms, and the advantage of daily clinics and lectures by a large number of men prominent in medicine, surgery and the specialities. The Polyclinic is in fact an educational club, where medical men from abroad will find an educational and social home.

For information concerning the Polyclinic address the Secretary, Major Vint, R.A.M.C. (retired), 22, Chenies Street, Gower Street, London, W.

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The Health of the Panama Canal.—Colonel Gorgas, in his report on the Department of Sanitation of the Isthmian Canal Commission for the month of October, 1910, states that the total number of deaths from all causes among employees was 42. These were divided as follows: From disease 23, and from external causes 19, giving the annual average per thousand of 10·19 for all causes.

The annual average per thousand of deaths in the cities of Panama, Colon, and the Canal Zone, including both employees and civil population, was 23·61.

Among employees during October, 1910, deaths from the principal diseases were as follows: Malarial fever, 1; hæmoglobinuric fever, 1; pneumonia, 7; tuberculosis, 3; dysentery, 2; leaving a balance of 9 from other diseases, there being no deaths during the month from typhoid fever.

No cases of yellow fever, small-pox, or plague were brought to, or originated on, the Isthmus during the month.

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Paraguay Maté Tea has long been used in several South American countries to the exclusion of the Indian and China teas in use in Europe and Asia. Several potent ingredients of a nourishing and sustaining character are claimed to bestow useful qualities upon Paraguay Maté, but the absence of tannic acid in the decoction is, perhaps, its chief recommendation, especially for pronouncedly dyspeptic people.

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A grand prize has been conferred upon Messrs. Burroughs Wellcome and Co. for their exhibit at the International Hygienic Exhibition, held in Buenos Aires in 1910.

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The proprietors of Jeyes' fluid have had the honour to receive the Warrant of Appointment to His Majesty King George V. for disinfectants.

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Professor Gallé, of Rome, has found Leishman-Donovan bodies in a case of "ponos" by puncture of the spleen. The patient dwelt in the island of Spezzia, off the coast of Corinth, Greece.

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Messrs. Meister Lucius and Brüning, Ltd., 51, St. Mary Axe, London, E.C., have now placed the "Ehrlich-Hata," an arsenic compound dioxydiamido arsenobenzol, generally known as "606," on the market, under the denomination "Salvarsan."

## Notes on Books.

THE BACTERIOLOGISTS' AID TO MEMORY[1] is a very useful chart and handy reference sheet devised by Captain J. W. S. Seccombe, M.R.C.S., L.R.C.P., D.P.P., R.A.M.C.

The sheet can easily be fixed up to the wall of the laboratory, or if preferred can be mounted on linen with rollers, and so rolled up after use and laid away.

The scheme of the chart consists in having a primary column of the well-known organisms, cocci and bacilli, and then other series of columns showing the reactions of these different germs on agar, blood agar, broth, blood serum, glucose, lactose, mannite, and many other media used in bacteriology. Finally, at the end is a place for remarks, the salient points of each bacterium being shortly noted.

The value of such a chart is, of course, that one can get in a moment the individual reaction of any organism on any given medium without having to go through the laborious process of looking it up in a text-book.

There are so many organisms now with such devious reactions on different media that some such scheme as this is absolutely necessary as an aid to memory.

"A SUMMARY OF FACTS REGARDING MALARIA," suitable for public instruction. By Major Ronald Ross, C.B., F.R.S. London: John Murray, Albemarle Street, W., 1910. Pp. 15. Price 2d.

Malarial fever is perhaps, at the present time, the most important of human diseases. In India alone it has been officially estimated to kill every year on the average 1,130,000 persons. Major Ross's valuable pamphlet will prove of the greatest possible value in making known to the general public the best practical, everyday means for preventing the spread of malaria. With a view to widespread distribution, it is published at the nominal price of 2d. (postage 1d. for 3 copies).

SQUIRE'S POCKET COMPANION TO THE BRITISH PHARMACOPŒIA has reached its third edition and must prove a welcome addition to practitioners throughout the English-speaking world. The small volume contains a review of therapeutics and pharmacy from 1908 to 1910, and gives suggestions of suitable preparations with which to prescribe the several drugs mentioned in the text.

The "Pocket Companion" is presented gratis to the members of the medical profession on application, it gives an up-to-date review of medical and pharmaceutical topics, and it cannot fail to satisfy every one who reads the volume.

Application to be made to Messrs. Squire and Sons, 413, Oxford Street, London, W.

DR. MALCOM WATSON, we are informed, has just published a book entitled "The Prevention of Malaria in the Federated Malay States." Professor Ronald Ross contributes a preface. The book is well illustrated, runs to 140 pages, and the price is 7s. 6d., post free.

Only 500 copies have been issued, and all desirous of possessing one should apply at once to the Clerk of the Laboratory, Liverpool School of Tropical Medicine University, Liverpool.

[1] The chart is printed and published by John Bale, Sons and Danielsson, Ltd., Oxford House, 83-91, Great Titchfield Street, Oxford Street, W. Price 3s. 6d. net. Mounted on linen 4s. 6d. net.; Mounted on linen, with rollers, 5s. 6d. net.

## Publications.

THE Wellcome Laboratory workers have recently published the following important results of their investigations:—

(1) "Some Colour Reactions of Adrenine and Allied Bases," by A. T. Ewins.

(2) "A Third Active Principle in Ergot Extracts," by George Barber and H. H. Dale, M.D.

(3) "Synthesis of *p*-Hydroxyphenylethylalkylamines," by G. S. Walpole.

(4) "A Method of Titrating Physiological Fluids," by C. S. Walpole.

(5) "The Alleged Formation of Adrenine from Tyrosine," by E. T. Ewins and P. P. Laidlaw.

(6) "The Presence of Ergot and Physiological Activity of β-imidazolylethylamine," by G. Barber and H. H. Dale.

## NOTICE.

BRITISH MUSEUM (NATURAL HISTORY).

Now ready, volume v. of the "Monograph of the Culicidæ, or Mosquitoes." Mainly compiled from collections received at the British Museum (Natural History) from various parts of the world. By Fred. V. Theobald, M.A. Pp. xv., 646; 6 plates and 261 text-figures. London, 1910, 8vo. Published by the Trustees of the British Museum. Price £1 5s.

The present volume is the third of the supplementary volumes issued since the appearance of Mr. Theobald's original work on the Culicidæ, in two volumes, with an atlas of plates, published by the Trustees in 1901 in connection with the investigation into the cause of malaria conducted by the Colonial Office and the Royal Society. It contains an account of 21 genera and 392 species not included in volumes i. to iv. The work has a character more comprehensive than that of a mere supplement, since the species described in the previous volumes of the series are given in their proper systematic order in the present volume, and are included in the respective analytical keys.

Sold by Longmans and Co., 39, Paternoster Row, E.C.; B. Quaritch, 11, Grafton Street, New Bond Street, W.; Dulau and Co., Ltd., 37, Soho Square, W.; and at the British Museum (Natural History), Cromwell Road, London, S.W.

## Personal Notes.

COLONIAL MEDICAL SERVICES.

*West African Medical Staff.*

*Death.*—A. B. S. Powell, L.R.C.P., L.R.C.S.Edin., L.F.P.S. Glas., Medical Officer, Southern Nigeria.

*Retirement.*—H. B. Kent, M.B., B.S.Lond., M.R.C.S.Eng., L.R.C.P.Lond., Medical Officer, Southern Nigeria.

*Resignation.*—F. G. Sharpe, L.R.C.S., L.R.C.P.Irel., Medical Officer, Gold Coast.

*Transfer.*—J. J. Moore, L.R.C.S., L.R.C.P., L.M.Irel., D.P.H.Liverpool, D.T.M.Liverpool, Medical Officer, has been transferred from Sierra Leone to Southern Nigeria.

*No Promotions.*

*Appointments.*—E. J. Tynan, F.R.C.S., L.R.C.P.Irel., D.P.H.Dublin, D.T.M.Liverpool, Medical Officer, Southern Nigeria, has been seconded for service as Health Officer to the Lagos Municipal Board of Health.

*Other Colonies and Protectorates.*

G. D. H. Carpenter, M.B., Ch.B.Oxon, M.R.C.S.Eng., L.R.C.P.Lond., has been selected for temporary appointment as a Medical Officer in Uganda.

## Recent and Current Literature.

*A list of recent publications and articles bearing on tropical diseases is given below. To readers interested in any branch of tropical literature mentioned in these lists the Editors of the* JOURNAL OF TROPICAL MEDICINE AND HYGIENE *will be pleased, when possible, to send, on application, the medical journals in which the articles appear.*

### "Bulletin Manila Medical Society," October, 1910.

(1) GANGOSA IN GUAM.

Dr. Garrison, United State Navy, states that "gangosa" means, in Spanish, "talking through the nose," or "snuffles." There are 324 cases in the island of Guam. One-third of the patients had lesions originating in the nose, pharynx, or palate, one-third had lesions in nose and elsewhere, and one-third elsewhere but not in the nose. The favourite sites, other than the nose and mouth, are the fingers and toes, ankles and wrists, elbows and knees, neck and forehead about the hair-line, and in some cases every square inch of skin was affected. The skin, soft parts, bones, joints, and tendon sheaths, may all be attacked. There are no important blood changes, no fever, and but little pain. Some cases heal in a few weeks; in others the disease may last twenty, or even thirty, years. Rigid asepis, curettement, and cauterization, often repeated, will heal most cases. Arguments for and against the disease being syphilis are considered. Dr. Garrison finally concluding that the disease is a late manifestation of syphilis; he states that bichloride of mercury and potassium iodide cure the complaint.

(2) DOUBLE-PORED TAPEWORM (DIPYLIDIUM CANINUM) IN MAN.

D. G. Willets draws attention to the presence of this worm in man. Blanchard has gathered evidence of the presence of the parasite in the following countries: Denmark, 21 cases; Germany, 16; Switzerland, 7; France, 5; Austria, 3; Russia, 3; England, 2; Holland, 1; Norway, 1; and Sweden, 1; 60 in all.

The adult stage of the parasite is found in dogs, cats, and man; the cysticercoid stage (*Cryptocystis trichodectis*) in lice (*Trichodectes canis*) and fleas (*Pulex serraticeps; P. irritans*).

The life-history is as follows: Mature segments of the adult parasite are passed from the anus of a dog either with the fæcal material or spontaneously. Becoming lodged in the fur of the host, the segments undergo disintegration and the parasitic vermin of the dog feed upon the liberated ova, thus infecting themselves with the cysticercoid stage of the parasite. The dog now bites and swallows the infected vermin, and thus reinfects himself. It is assumed that man becomes infected through undue familiarity with dogs and cats which have upon them lice or fleas harbouring the cysticercoid stage. It is not difficult to see how such an infection could occur when the custom of dogs licking the hands of their friends is recalled. It may be that vermin of cats and dogs infect human beings directly (Braun). *Dipylidium caninum* is a very frequent parasite of dogs, less so of cats.

Prophylaxis consists in giving dogs and cats frequent soap-and-water and antiseptic baths, and in guarding against undue familiarity between children and their pets.

While male fern or thymol may, after the usual fasting and cleansing of the bowel, be given to an adult, pomegranate and kamala have been chiefly used in treating cases occurring in young children. Seeing that the heads of the parasites are not easily expelled, the stools should be examined again at the end of about a month to see if segments are present.

### "The China Medical Journal," November, 1910.

C. W. Young, of Peking, describes vegetable bodies of different kinds found in the fæces of man. A great variety of structures of vegetable origin are found normally in the fæces, while members of another large group may occur there accidentally. As Dr. Young points out, the value of their detection lies in the fact that they may be mistaken for pathological human tissues or parasites, and it is therefore important that they be recognized.

### "Bulletin de la Société de Pathologie Exotique," October 12, 1910.

Darling records a case of sarcosporidiosis in the opossum. The animal was captured at the dairy of Ancon Hospital (Canal Zone), and upon removing the skin from its abdomen numerous white, slightly oval, shotty nodules, 1 to 2 mm., were seen. These on examination were found to be sarcosporidia cysts. A large number of the striated muscles were affected, as were also the heart, lungs, stomach, small intestine, pericardium and œsophagus.

Inoculation experiments were performed on guinea-pigs, the sporozoites being injected intramuscularly. One guinea-pig, sixty days after inoculation, was found on microscopic examination to be infected. In another guinea-pig no infection apparently resulted.

### "Journal of the American Medical Association," December 17, 1910.

Russ, of San Francisco, describes a case of elephantiasis of the scrotum and penis, with the operation he performed on it. The case would seem to have been an ordinary filarial one, the chief interest in it lying in the fact that the patient had only apparently been exposed to infection on two occasions for periods of very brief duration, For example, he had been in Mexico in 1900, for three months, and in 1902 again for six months. Apart from these visits there was no other history of tropical exposure.

## Notices to Correspondents.

1.—Manuscripts sent in cannot be returned.

2.—As our contributors are for the most part resident abroad, proofs will not be submitted to those dwelling outside the United Kingdom, unless specially desired and arranged for.

3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.

4.—Authors desiring reprints of their communications to the JOURNAL OF TROPICAL MEDICINE AND HYGIENE should communicate with the Publishers.

5.—Correspondents should look for replies under the heading "Answers to Correspondents."

# Original Communications.

## TRYPANOSOME DISEASES OF DOMESTIC ANIMALS IN UGANDA.[1]

### TRYPANOSOMA NANUM (*Laveran*).

By Colonel Sir DAVID BRUCE, C.B., F.R.S., A.M.S.; Captains A. E. HAMERTON, D.S.O., and H. R. BATEMAN, R.A.M.C.; and Captain F. P. MACKIE, I.M.S.

(Sleeping Sickness Commission of the Royal Society, Uganda, 1908-10.)

### INTRODUCTION.

ONLY two cattle (Experiments 503 and 1118) examined by the Commission at Mpumu were found to harbour this trypanosome in their blood. Both came from the Uganda Company's estate at Namukekera, some fifty miles from Lake Victoria, and both had become infected on the estate.

This species differed from *Trypanosoma pecorum* in that it did not affect the smaller laboratory animals, such as monkeys, dogs, rats, or mice. Guinea-pigs were also refractory to the disease. Horses, mules, donkeys, and rabbits were not available at Mpumu, so that it is impossible to say what would have been the effect of inoculation in them. Oxen and goats were inoculable, but the only sheep experimented on failed to become infected, although inoculated with the same blood which infected a goat.

It seems rash to recognize *T. nanum* as a Uganda species on the insufficient evidence at our disposal; but yet the fact remains that this trypanosome in every case failed to infect the smaller animals, and, moreover, by placing these cases on record it will draw the attention of future workers to its possible presence.

### MORPHOLOGY OF TRYPANOSOMA NANUM.

#### A. *Living, Unstained.*

*T. nanum* is indistinguishable from *T. pecorum* in the fresh and living condition.

#### B. *Fixed and Stained.*

*Length.*—The following table gives the average length of this trypanosome in the ox and goat. Twenty trypanosomes are drawn and measured from each preparation, the average length reckoned, and the length of the longest and shortest given :—

TABLE I.—TRYPANOSOMA NANUM.

| No. of experiment | Animal | Method of fixing | Method of staining | In Microns | | |
|---|---|---|---|---|---|---|
| | | | | Average length | Maximum length | Minimum length |
| 503 | Ox | Osmic acid | Giemsa | 13·3 | 15·0 | 11·0 |
| 983 | ,, | ,, | ,, | 13·1 | 14·0 | 12·0 |
| 698 | Goat | ,, | ,, | 13·9 | 16·0 | 13·0 |
| 698 | ,, | ,, | ,, | 15·2 | 16·0 | 12·0 |
| 882 | ,, | ,, | ,, | 12·9 | 15·0 | 11·0 |
| 883 | ,, | ,, | ,, | 13·3 | 15·0 | 11·0 |
| 1691 | ,, | ,, | ,, | 13·7 | 16·0 | 12·0 |
| .. | .. | .. | .. | 13·6 | 16·0 | 11·0 |

[1] A Communication read before the Royal Society, December 8, 1910.

The average length of *T. nanum* corresponds closely with that of *T. pecorum*, which was 13·3 microns. The question arises as to whether it would not be better for the sake of simplicity to include, for the present at least, this species in that of *T. pecorum*. If the morphology is the same, if the important domestic animals are susceptible to both, if the geographical distribution is the same, and if the carrier is found to be the same, there seems little need of separating the two under different names.

*Breadth.*—At the widest part from 1·5 to 2·5 microns.

*Shape.*—Much the same as *T. pecorum*, but perhaps slightly narrower, due to the less development of the undulating membrane.

*Contents of Cell.*—As a rule homogeneous.

*Nucleus.*—Oval and situated about the middle of the body.

*Micronucleus.*—Small and rounded, and situated near the posterior extremity.

*Undulating Membrane.*—Perhaps a little narrower and simpler than in *T. pecorum*. It was thought to be applied more closely to the body and less thrown into folds than in that species.

*Flagellum.*—There is no free flagellum.

TABLE II.—SHOWING THE DISTRIBUTION IN RESPECT TO LENGTH OF ONE HUNDRED INDIVIDUALS OF T. NANUM UGANDA, 1909.

| No. of experiment | Microns | | | | | | Average, in microns |
|---|---|---|---|---|---|---|---|
| | 11 | 12 | 13 | 14 | 15 | 16 | |
| 689 | — | — | 7 | 8 | 4 | 1 | 13·9 |
| 698 | — | 1 | — | 2 | 7 | 10 | 15·2 |
| 882 | 1 | 5 | 10 | 3 | 1 | — | 12·9 |
| 883 | 1 | 4 | 5 | 7 | 3 | — | 13·3 |
| 1691 | — | 1 | 2 | 8 | 8 | 1 | 13·7 |
| Totals .. | 2 | 11 | 24 | 28 | 23 | 12 | .. |
| Percentages | 2·0 | 11·0 | 24·0 | 28·0 | 23·0 | 12·0 | .. |

TABLE III.—SHOWING THE DISTRIBUTION IN RESPECT TO LENGTH OF TWO HUNDRED AND SIXTY INDIVIDUALS OF T. PECORUM UGANDA, 1909.

| No. of experiment | Microns | | | | | | | | | | | Average, in microns |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | |
| 82 | — | — | 2 | 6 | 8 | 3 | 1 | — | — | — | — | 11·7 |
| 505 | — | — | 2 | 2 | 9 | 4 | 1 | 2 | — | — | — | 12·3 |
| — | — | — | — | 2 | 3 | 6 | 6 | 3 | — | — | — | 13·2 |
| 593 | — | — | 1 | — | 2 | 1 | 3 | 7 | 5 | 1 | — | 14·5 |
| 44 | — | — | 4 | 2 | 5 | 3 | 6 | — | — | — | — | 12·2 |
| 559 | — | — | — | 2 | 9 | 4 | 4 | — | 1 | — | — | 12·7 |
| 461 | — | — | — | — | — | 5 | 4 | 1 | 2 | 6 | 2 | 15·3 |
| 543 | — | — | — | 2 | — | 2 | 6 | 6 | 4 | — | — | 14·3 |
| 1406 | — | — | — | 1 | 5 | 2 | 5 | 5 | 2 | — | — | 13·7 |
| 551 | 1 | — | 3 | 3 | 3 | 3 | 3 | 2 | 1 | — | 1 | 12·6 |
| 626 | — | — | 3 | 2 | 3 | 2 | 7 | 3 | — | — | — | 12·8 |
| 398 | — | — | — | — | — | 1 | 9 | 6 | 4 | — | — | 14·6 |
| 398 | — | — | 1 | 1 | 3 | 9 | 4 | — | 1 | 1 | — | 13·1 |
| Totals .. | 1 | — | 16 | 23 | 50 | 45 | 59 | 35 | 20 | 8 | 3 | ... |
| Percentages | 0·4 | — | 6·1 | 8·8 | 19·2 | 17·3 | 22·7 | 13·5 | 7·7 | 3·1 | 1·2 | .. |

From a comparison of Tables II and III, Chart I, and stained figures of the two species, it is evident that *T. pecorum* and *T. nanum* resemble each other very closely morphologically.

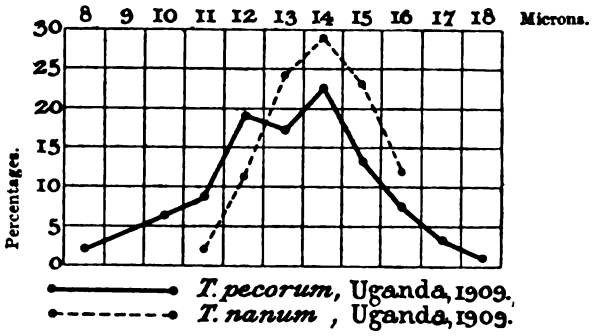


CHART 1.—Giving curves representing the distribution, by percentages, in respect to length of *T. pecorum*, Uganda, 1909, and *T. nanum*, Uganda, 1909.

## COMPARISON OF T. NANUM, UGANDA, 1909, WITH T. NANUM, SUDAN, 1904.

Thanks to Dr. Andrew Balfour, the Director of the Wellcome Research Laboratories, Khartoum, the Commission was enabled to compare the Uganda strain with the original Sudan strain.

TABLE IV.—MEASUREMENTS OF DR. BALFOUR'S SUDAN STRAIN OF T. NANUM, 1904.

| Animal | Method of fixing and staining | In Microns | | |
|---|---|---|---|---|
| | | Average length | Maximum length | Minimum length |
| Ox | ? | 12·9 | 15·0 | 11·0 |
| ,, | ? | 12·7 | 14·0 | 10·0 |

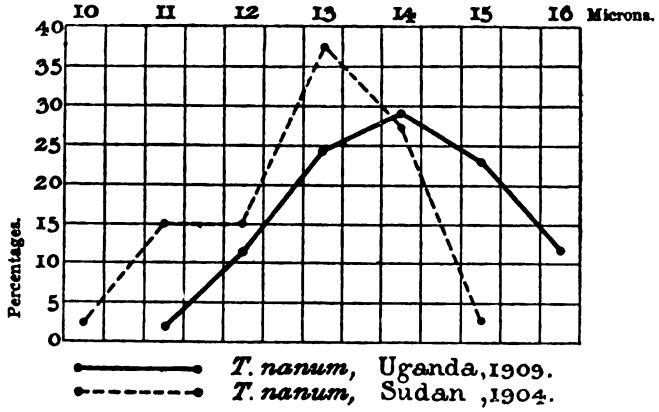


CHART 2.—Giving curves representing the distribution, by percentages, in respect to length of *T. nanum*, Uganda, 1909, and Dr. Balfour's *T. nanum*, Sudan, 1904.

From a comparison of these tables and drawings of the species there can be little doubt as to the identity as regards morphology of *T. nanum*, Uganda, 1909, and Dr. Balfour's *T. nanum*, discovered in the Sudan in 1904 :—

TABLE V. SHOWING THE DISTRIBUTION IN RESPECT TO LENGTH OF FORTY INDIVIDUALS OF T. NANUM, SUDAN, 1904.

| Animal | Microns | | | | | | Average, in microns |
|---|---|---|---|---|---|---|---|
| | 10 | 11 | 12 | 13 | 14 | 15 | |
| Ox .. .. | — | 3 | 4 | 6 | 6 | 1 | 12·9 |
| ,, .. .. | 1 | 3 | 2 | 9 | 5 | — | 12·7 |
| Totals .. | 1 | 6 | 6 | 15 | 11 | 1 | .. |
| Percentages | 2·5 | 15·0 | 15·0 | 37·5 | 27·5 | 2·5 | .. |

ANIMALS SUSCEPTIBLE TO T. NANUM, UGANDA, 1909.

| Date | No. of experiment | Source of virus | Period of incubation, in days | Duration of disease, in days | Remarks |
|---|---|---|---|---|---|
| | | | *Cattle.* | | |
| 1909 Feb. 5 | 503 | Nat. infec. | ? | 245 | From Namukekera. Died of *T. nanum* |
| June 25 | 1118 | ,, | ? | 3 | From Namukekera. Died of *T. nanum* |
| Sept. 29 | 780 | Ox 983 | — | — | Never showed trypanosomes; still alive after 47 days |
| June 11 | 982 | ,, 503 | — | — | Never showed trypanosomes; still alive after 141 days |
| ,, 11 | 983 | ,, ,, | 20 | 141 | Killed |
| | | | *Goat.* | | |
| Apr. 12 | 698 | Ox 503 | 25 | 137 | Died of *T. nanum* |
| May 21 | 882 | ,, | 26 | 91 | ,, ,, |
| ,, 21 | 883 | ,, | 6 | 46 | ,, ,, |
| Sept. 16 | 1691 | Oxen 503 and 982 | 8 | 12 | ,, ,, |
| | | Average .. | 16 | 71 | |
| | | | *Sheep.* | | |
| May 21 | 880 | Ox 503 | — | — | Never showed trypanosomes; still alive after 82 days |
| | | | *Monkey.* | | |
| Apr. 10 | 687 | Ox 503 | — | — | Died; under observation 23 days |
| June 26 | 1168 | ,, 1118 | — | — | Never showed trypanosomes; still alive after 141 days |
| ,, 26 | 1169 | ,, ,, | — | — | Never showed trypanosomes; still alive after 97 days |
| | | | *Dog.* | | |
| May 21 | 884 | Ox 503 | — | — | Died; under observation 66 days |
| June 30 | 1194 | Goat 883 | — | — | Died; under observation 42 days |
| ,, 30 | 1195 | ,, | — | — | Never showed trypanosomes; still alive after 43 days |
| ,, 30 | 1196 | ,, | — | — | Died; under observation 26 days |

| | | | | | |
|---|---|---|---|---|---|
| | | *Guinea-pig.* | | | |
| Apr. 10 | 689 | Ox 503 | — | — | Never showed trypanosomes; still alive after 59 days |
| June 26 | 1162 | ,, 1118 | — | — | Never showed trypanosomes; still alive after 36 days |
| ,, 26 | 1163 | ,, ,, | — | — | Never showed trypanosomes; still alive after 36 days |
| ,, 26 | 1164 | ,, ,, | — | — | Never showed trypanosomes; still alive after 36 days |
| | | *Rat.* | | | |
| Feb. 9 | 529 | Ox 503 | — | — | Experiment stopped; alive after 44 days |
| ,, 9 | 530 | ,, ,, | — | | Experiment stopped; alive after 44 days |
| Apr. 10 | 688 | ,, ,, | — | — | Experiment stopped; alive after 59 days |
| ,, 12 | 717 | ,, ,, | — | — | Experiment stopped; alive after 57 days |
| June 26 | 1165 | ,, 1118 | — | — | Experiment stopped; alive after 57 days |
| ,, 26 | 1166 | ,, ,, | — | — | Experiment stopped; alive after 57 days |
| ,, 26 | 1167 | ,, ,, | — | — | Experiment stopped; alive after 57 days |
| May 21 | 885 | Goat 698 | — | — | Experiment stopped; alive after 80 days |
| | | *Mouse.* | | | |
| Apr. 10 | 690 | Ox 503 | — | — | Experiment stopped; alive after 59 days |

* Duration includes the days of incubation; it dates from the day of infection.

### Cultivation of T. nanum.

No attempt was made at Mpumu to cultivate *T. nanum*.

### The Carrier of T. nanum.

Of the two experiments made at Mpumu with *T. nanum* and *Glossina palpalis*, one was unsatisfactory and the other negative. Since the two oxen supposed to be suffering from *T. nanum* disease came from Namukekera, where it is stated there are no tsetse flies, it is probable that *T. nanum*, like *T. pecorum*, is carried by some species of biting fly other than *Glossina*.

### Conclusions.

1. *T. nanum* is indistinguishable from *T. pecorum* either in the living condition or when fixed and stained.

2. It differs from *T. pecorum* in not being pathogenic to the smaller laboratory animals.

3. The carrier of *T. nanum* is probably the same as that of *T. pecorum*, as both diseases occur under the same conditions, but there is no evidence available as to what the carrier is.

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The Philosophic Faculty of the University of Marburg recently conferred the degree of Doctor *Honoris Causa* upon Mr. Ernest Leitz, of Wetzlar, principal of the well-known optical and microscopical firm of that name.

## TROPICAL LIFE AS IT AFFECTS LIFE ASSURANCE.

By James Cantlie, M.B., F.R.C.S.

In the Journal of Tropical Medicine and Hygiene, January 2, 1911, appears a letter by Mr. David Paulin, Manager, Scottish Life Assurance Company, Limited, refuting statements made by me at the dinner of the London School of Tropical Medicine. It has taken a long time to elicit any remarks on the subject of life insurance in the Tropics, which I have dealt with on several occasions. The first article I wrote on the subject appeared in the *British Medical Journal* of June 12, 1897. Again, in November, 1903, I read a paper before the Life Assurance Medical Officers' Association in London, which was discussed during two meetings of the Association by several of the medical officers of the best-known insurance companies in this country. On yet another occasion, at the meeting of the Royal Institute of Public Health in 1904, I opened a discussion on the same subject.

In preparing my paper for the Association of Medical Officers, I previously communicated with most of the important insurance companies on the subject, and at the last-named meeting I invited the representatives of all the best-known companies dealing with life assurance in London. Four insurance companies were represented at the meeting, but not one of the representatives in any way disagreed with my statements. In conversation with one of these representatives after the meeting, he told me it was useless to propose any alterations to insurance companies; they were hand in glove with each other, and, as he put it, a subject of the kind would be settled by a visit from one to the other on the day following the appearance of the paper, and an agreement made to take no notice of the matter. No company, he said, can act independently; and the weight of influence was such that the adoption of a suggestion, however good, emanating from an irresponsible source would not even be considered seriously, far less acted upon.

Until Mr. Paulin, in his letter, attacked my statements, no insurance authority has taken any notice, publicly at all events, of my suggestion, although I gather some companies are now following along the lines I advocated. I am much obliged to Mr. Paulin for favouring me with a reply. I am also pleased to know that one at least of my statements is refuted—namely, "that insurance companies thrive by dropped policies—" but Mr. Paulin has not quite grasped the point at issue. If, however, by a fuller explanation Mr. Paulin can be induced to give us the benefit of a more intimate knowledge of the working of insurance companies—then the laity will be thankful.

The question before us seems to resolve itself into, "Does residence in a warm climate shorten the life of Europeans?" In order to narrow the question, however, I will merely deal with British-born folk leaving the British Isles to take up residence in one of our British colonies, protectorates, or settlements. We have therefore to deal with a people dwelling between 50° and 60° north of the Equator, in a climate rendered temperate by being insular, who, by virtue of circumstances, proceed in numbers

to countries nearer the Equator, and therefore warmer.

*Regions for which an Extra Premium is charged.*—In insurance prospectuses I see that a dangerously warm country is regarded as one situated within 33° north of the Equator and about 30° south. To one who has travelled much in the Tropics, the application of this enunciation to individual regions must appear, in many ways, absurd in its limitations. In Central Africa, even—that much-maligned region of the earth as regards its climatology and healthfulness—there are large areas which enjoy a salubrity of climate unsurpassed in any part of the world, tropical or temperate. In the West Indies, so usually stamped as sickly, there are islands, such as Barbadoes, in which malaria is unknown, and in the island of Jamaica climate of every variety, from tropical to cold, is to be found. In many of the Pacific Islands, likewise, an equable, enjoyable, and healthy climate is recorded; and in India, the Neilgherries, and several other parts, are accredited with the same attributes. Thus, there are many health oases in the Tropics which refute the attribute of being unhealthy, even although they lie within the area pronounced by the insurance company to be "dangerous."

*No Statistics available.*—I may say at once, that if you expect statistics to be forthcoming, suitable as a basis on which to found scientifically accurate estimates as to the value of life in the Tropics, whether of Europeans or natives, I cannot do so. There is no information available for such conclusions. To our Crown colonies and protectorates young men go out from this country in the prime of life, and, for the most part, after being carefully inspected medically. When they get ill they may be "invalided home" or seek change of climate locally. Again, the most serious illness in tropical countries—namely, malaria—incapacitates more often than it kills, and the meaning of the death-rate returns of Europeans in the Tropics cannot be gauged by the actuary who compounds his tables on information based on vital statistics collected in Britain. Even the carefully-compiled returns in Indian Army reports do not help us much, if at all, in arriving at a conclusion of any value. I will refer to this subject later, but it is beyond my power to help the actuary by figures.

*Who drew up the Present Extra-premium Rates?*—Who drew up the present rules that most insurance offices affect has often puzzled me; they were, most certainly, not the work of experienced medical men; and if by actuaries, then they may truly be said to have been drawn up "on general principles"; for there never existed, nor does there now exist, any reliable, or even approximately reliable, figures on which to ground an opinion. If by neither of these, therefore, on what are the extra-premium charges founded? I have no hesitation in saying they are based, for the most part, on the most unreliable of all information—namely, gossip—or on the tittle-tattle of the old-time ship captain, who mostly gained his information from frequenters of riverside wharves or polluted harbours. It may be, however, impossible to individualize too closely, and perhaps the insurance offices are justified in the main. Most offices, however, declare "that they deal with each case individually," yet the "dangerous" area exists in their prospectuses. If each case is to be dealt with individually, it would be but logical that the 33° N. and 30° S. limits ought to be withdrawn. The two statements are at variance.

*Is Heat the Factor of Danger?*—I would point out, however, if it is *heat* that is considered so dangerous to life, it must not be assumed that the nearer the Equator the more oppressive the heat, for the hottest parts of the earth are not equatorial, not even tropical, but sub-tropical merely. Mooltaun, for instance, one of the hottest parts of the earth, is 30½ degrees from the Equator—*i.e.*, 8 degrees, or some 580 miles, north of the Tropic of Cancer. In dealing with the subject it is necessary to remember that *warm countries* may be divided into *three zones: the equatorial, the tropical, and the sub-tropical.* (1) The *equatorial region* includes a belt round the earth 12 degrees (or about 800 miles) north and south of the Equator. It is characterized by an almost complete absence of climatic *contrasts;* air, soil, and water have a uniform temperature bordering on 80° F.; the day and night temperatures vary but a few degrees; and there is no appreciable difference of season. Everything reeks with moisture, and few storms stir the atmosphere. In so far, therefore, as climate is concerned, this is the most *uniform* of regions. (2) The *tropical* region—that is, the region of the earth between, say, 12° and 22° north and south—is marked by distinctly tropical summers, with the wet season during the hot weather, and by marked seasons—the winters being cool. It is the region of strong winds and of typhoons or cyclones. (3) Beyond the tropical limits are *sub-tropical* regions with, in many parts, fierce heat in summer and severe cold in winter, and in many cases marked contrasts between night and day temperatures.

*Difference of Climates and Diseases North and South of the Equator.*—It may be well to divide the world, in regard to its *pathology*, into the regions to the north and south of the Equator. That the climatology of countries to the north and south of the Equator differs is well known, and it may be that for this reason the diseases differ also. There are two factors at once apparent which enter into this argument: *First*, that in the Eastern Hemisphere, at any rate, the great bulk of *land* is to the north of the Equator, and that, therefore, the climate is more of a *continental* type; and, again, the countries to the north of the Equator have been inhabited for a longer time, and by denser masses of human beings, more especially in Asia. It may be that the *soil* of the older countries has become contaminated by the excreta or bodies of dead animals and human beings, through a long series of years, from which the sparsely-populated continents of Australia, and South America, and of the promontory of Africa, south of the line, have been free. Be this as it may, there is no doubt that not only the climatology, but also the diseases, to the north and south of the line, differ considerably, be the explanation what it may. I therefore propose to deal chiefly with the area of the Eastern Hemisphere north of the line, for it is there the human race is chiefly collected, and the countries to the south of the Equator have a more recent and

very much less dense population—one that *overflows* merely from the great continents to the north. Throughout this paper, therefore, unless otherwise mentioned, I deal chiefly with the countries of the Eastern Hemisphere to the north of the Equator.

*The Effect of a Warm Climate upon British-born Folk.*—When one born and brought up to adult years in Britain takes up residence in a warm climate, the heat acts as a stimulant. The *physiological* processes are increased in activity, appetite is good, digestion is excellent, and work and recreation are performed with unwonted vigour. The heat is enjoyed, and even where heat and moisture prevail, constituting the "trying" time of the year, the new arrival makes light of it. The *liver* is called upon for extra work, as proved by the copious loose bilious stools which are passed, resulting in a buoyancy of spirits and a feeling of fitness.

In some six to eight months, however, the *initial* stimulus wanes. The pitch of physiological excess at which the digestive and cutaneous organs have been working cannot be maintained, and the *opposite* obtains. The vigorous appetite flags, and may want stimulating by either alcohol, hot curries, or other means; digestion becomes impaired, involving drowsiness and abdominal fulness and flatulence soon after meals; the loose motions are succeeded by constipation, with stools of a light colour; the muscular energy lessens, and exercise is rather an ordeal. This is the critical period of the British-born tropical resident, and it depends partly upon the strength of body and of will whether he regains the normal, after the physiological maximum and minimum through which he has passed. If the organs of the body were sound to start with, in all probability no permanent damage will ensue; but if the digestive tract had been faulty before he left home for tropical life, there is a great tendency to real organic impairment. Should, however, a person starting even with healthy organs succumb to the lethargy which tropical life engenders, in all probability ill-health will soon overtake him. It is usually about two years after taking up residence in a warm country that effects of climate are manifested; and it depends upon the "soundness of wind and limb," and the strength of character of the individual, what the future is to be.

One of the most deterrent influences to the health of the white man in the Tropics is want of proper *rest and sleep* at night. This is induced by retiring too soon after a heavy meal, by restlessness due to heat, to mosquitoes, to the closeness consequent upon the use of the mosquito-net, &c. Whatever the causes—be they from external or internal influences—want of proper rest at night is a sure provocative of ill-health and of liability to contract disease.

*Old and Young in the Tropics.*—After a certain period of residence in the Tropics, most men become perfect sages in their wisdom of how to keep their health in a hot climate. Everyone is a hygienist unto himself, and is ever ready to impart his knowledge gained from personal experience. He watches his health intently; studies what he is to eat and drink as part of his day's work. Every man becomes a law and a physician unto himself, and by this method old residents in the Tropics can maintain their health in a truly wonderful manner. It is, therefore, not with the older residents the danger lies; it is the newly-arrived young man whose path is beset with danger. It is during the first five years of tropical life, therefore, that insurance offices run extra risks, and during that period, and that period only, that an extra premium need be charged.

The younger the age at which a man proceeds to the Tropics the greater the risk of contracting disease. The chances of a youth of 18 to a man of 25 contracting disease are about 2 to 1; and to a man of between 30 and 40 about 10 to 1. I never have any hesitation in recommending a healthy man of between 30 and 50 to proceed to the Tropics to take up work there; but I do my best to dissuade any one under 21 doing so. Every year of life over 21 lessens the chance of contracting illness, and a healthy man of 50 has a 50 per cent. better chance of combating the climatic effects and of remaining immune from disease than a youth under 20.

*The Insuring of Young Men.*—It is evident that for *insurance purposes* this is most unfortunate. A youth of 20 whose earning power is but little, and who to get his life insured has to pay an extra premium which may momentarily handicap him, is the very individual for whom an extra premium is most required. A man of, say, 30 to 35, who intends to take up work in the Tropics, is usually earning a larger salary, and the extra premium falls more lightly upon him; and yet the insurance office has, say, a 30 per cent. less risk.

*Insurance Anomalies.*—The insurances offices say, "Well, we slump the risks, and what we lose by the younger men we gain on those of more mature years." Many hardships are, however, incurred therefrom. But yesterday I saw a nurse proceeding to one of our colonies, a healthy woman, aged 40, who had to pay an extra premium of £10 a year; her actual annual salary amounting to about £60. I know also of *patients* who, on being recommended to go to a warm climate by their physician, had to pay an extra premium to their insurance offices—a most anomalous state of affairs. They were being sent to the only place in the world where health could be obtained and where their lives could be prolonged, yet they are asked to pay an extra premium for their doing so.

I have known men who, after long residence in a warm climate, find they cannot keep their health at home, and go abroad again to live. They have paid an extra premium on their life insurance whilst abroad; this has been rebated when they came home, but again enforced when, in order to live at all, they have gone to the part of the world which suits them best; the insurance office in this instance remitting the extra premium in the only place where their client could not live—namely, at home.

What, then, are insurances offices to do, or what guide are medical men who know tropical life to offer them?

*How to Deal with the Insurance of Tropical Lives.*—The insurance offices for the most part state: "We deal with each case individually; we have no fixed procedure for clients about to leave this country to take up residence in the Tropics." I offered a scheme

for dealing with this problem in the *British Medical Journal* of June 12, 1897, and although the insurance offices at the time condemned it as unpracticable, I see a few have adopted the principles I laid down. The principles of the scheme were as follows :—

*The Tropical Extra Premium.* — The following method of dealing with the extra premium demanded of a resident in the Tropics is suggested :—

(1) After seven years' residence in a "proscribed" country (that is, a region for which an extra premium is charged by an insurance office) the extra premium should be reduced by one-half. This step to be conditional upon a certificate from the company's medical officer that no permanent injury to health has been incurred, the expense of such certificate to be borne by the insured.

(2) That after ten years' residence in a proscribed region the extra premium be reduced to, say, one-third of the original sum charged, provided a medical certificate be forthcoming that no permanent injury has been incurred.

(3) That for the three following years one-fourth only of the original sum charged as extra premium be demanded, provided the requisite certificate be produced.

(4) That after the thirteenth year of residence in a proscribed region, no extra premium be charged, provided the necessary certificate be shown.

At the time I wrote the above I thought—and after some years of consideration I still think—that theoretically this scheme was a good one, but, like every scheme, it has its faults. The chief fault lies in the fact that a young man commencing life is called upon to pay an extra premium just when his means are small; a £10 increase in his annual premium is a matter of moment, and it may be altogether impossible for him to pay it. Ten pounds in rupees or Mexican dollars to a young bank clerk, for instance, is a serious sum, and I would like someone to devise a scheme whereby this hardship might be overcome. Let me suggest one.

*An Alternative Scheme.*—Suppose a young man aged 18 insures his life for, say, £1,000, when he enters a merchant shipping office in the City of London. After two or three years in this office he usually has to go abroad to one of the offices of the company. Suppose he goes to Ceylon or Hong Kong, an extra premium of, it may be, £10 or thereby, is imposed upon him, a sum which it may be, and often is, quite impossible from his small salary to meet. To overcome this difficulty, I would suggest that the insurance company does not increase the annual payment but reduces the liability, say, from £1,000 to £750; or in the case of a more unhealthy region, say, Mauritius or British Guiana, to even £500 for, say, the first five or seven years, and then, according to medical report, abate or reduce the restrictions. This would free the young man from increasing his payment, and at the same time diminish the risk of the company satisfactorily. I do not know if business men would accept the principle, but to me it seems feasible and fair.

It is said, I know not with what truth, that life insurance companies, even British companies, calculate upon policies lapsing as part of their assets. It is said to be part of the routine on which their business is founded, that only one out of three policies reach "maturity" (if that is the correct word); and the lapsing of a policy is a distinct gain to the company. I cannot believe this to be true; it surely cannot be that any company can be legally (not to mention honour in the matter) allowed to take money from the public on such terms. That it pays a company to take money for a time, and then, through a quibble it may be, to hope their client may cease to pay them further, is a position in which any company or group of men may earnestly pray "that they be not led into temptation." Many young men, however, about to proceed to the Tropics are monetarily hampered by the extra amount asked of them, or the extra premium may be altogether beyond their power to pay, and they have to allow their policy to lapse, much to the benefit, evidently, of the company. Comment on the equity, I think it is called, of such a transaction I would rather pass over, as I am neither lawyer, actuary, nor business man, and evidently have no claim to be heard on the matter.

*Certain Diseases not met with in the Tropics.*—It must be remembered the commoner ailments one meets with in practice at home are seldom seen within the Tropics. *Scarlet fever* is unknown; *measles* is but rarely seen, although, of course, we are all familiar with the deadly outbreak in Fiji. *Small-pox* is as carefully warded off by vaccination amongst white people in the Tropics as at home. *Rheumatic fever* seldom occurs primarily within the Tropics, hence valvular diseases of the heart are rare. *Pneumonia* is uncommon; so that, viewed as regards the tendency to the more serious complaints prevailing in Britain, the Tropics would seem to be a sanatorium. In dealing with the deterioration of health in the Tropics, climate and disease both play a part. The climatic effects upon the new arrival I have already dealt with, and the condition a hot and moist climate induces, after say two years, tends to render the system less capable of resisting disease.

*Chief Dangers to Life in the Tropics.*—Excluding malaria, the alimentary tract and the abdominal organs generally suffer most markedly.

A healthy *heart* and *lungs* seem to be able to preserve their balance in a hot climate, and as these organs have usually been carefully inspected before the man has left home, it is seldom either cardiac or pulmonary troubles come within the ken of the medical practitioner in the Tropics. It is the organs below the diaphragm that give trouble. The young man who has come out at, say, the age of 18 is, after, say, two years in a warm country, very liable to digestive and bowel troubles—now constipation, now diarrhœa. A "chill"—that frequent cause of illness in the Tropics—may cause congestion of the liver, jaundice, or hepatitis, and the serious period commences. The physiological variations now become converted into pathological changes, and the future is uncertain. Dysentery may supervene, which, when it becomes more or less chronic or recurrent, necessitates a change of locality. The man is now an invalid, and may have to be sent home. If, however, he cannot afford to go home, he is patched up

for a time and continues his work under adverse conditions.

*Malaria*, the other great bugbear of tropical life, is at hand in almost all warm countries. As, however, we now know that malaria is preventible, the dread of this scourge is lessening. Countries are classified as unhealthy according to their malarial infection; but when our acquired knowledge is brought to bear on practical hygiene, malaria will lose its terrors.

No insurance company, I take it, would have insured the lives of Drs. Low and Sambon when they went to live in the Roman Campagna during the most malarial period of the year, yet they came back without being infected and in excellent health. The mosquito-net was the sole protector. So it will be in all malarial lands. Any one can defy malaria who wards off the mosquito. And not only malaria, for the United States Army Commission have proved that yellow fever can be prevented in a similar manner. In the West Indies, therefore, where malaria and yellow fever are the scourges, there is no reason why one should contract either of these diseases. So keenly has this come home to us that many declare that the Tropics are dangerous to the white man only through their diseases, not through their climate. Ward off malaria, and health is capable of being enjoyed in any climate. Whilst not, perhaps, going so far as to say that climate has no deleterious effect, I do claim that in the Tropics, if malaria can be prevented, the white man can resist the effect of a hot climate for an indefinite time.

It must, however, be remembered that malaria (the disease that renders countries unhealthy) is a disease that incapacitates much more frequently than it kills. The malarial patient becomes an incubus to his employer, but not a tax upon the insurance companies as a rule. He is invalided home, or remains where he is until the initial effects of fever pass away and he becomes more or less immune. That his ailment may shorten life, if the tissue changes it induces are marked, there can be no doubt; but if he leaves the Tropics and comes home (it may be for good) in all probability recovery is complete and the effect upon his length of days infinitesimal.

This brings up the question of the longevity of old tropical residents. We assume that they have passed through their initial malarial fevers and have adapted themselves to tropical life, with occasional changes, for, say, thirty years. Does this man when he comes home live as long as his contemporaries who have never been subjected to the ailments of tropical life? Unless there are marked organic changes (which, in the majority of instances of old tropical residents, there need not be) I do not think life is shortened, and that therefore the insurance office is the gainer by a thirty years extra premium charged. We see in the obituary columns of our daily papers notices of old tropical residents, civilians and military, who attain great ages, and who have, no doubt, passed through the ailments common to everyone in the Tropics, and it must be within the knowledge of everyone in this country of cases of advanced age in returned tropical residents.

*Diet in the Tropics.*—I have said nothing about *food* or *alcohol* or manner of living. In most parts of the Tropics good food cannot be had. The beef and mutton which are obtainable in most tropical countries are of a different quality to that which appears on British tables at home. Cattle are used as draft animals before being slaughtered; and the geographical distribution of sheep is such that the animals may have to be brought from a distance. In the region of the world I know best—namely, South China—there are no sheep; in parts of Japan there are no sheep; and in other parts of the Tropics sheep cannot live. It is easy, then, to believe that the food in many tropical latitudes has not the nourishing qualities it has in England, and in many places fresh beef and mutton of any description cannot be had. This is a prominent cause of "running down," and always a severe tax on digestive organs already upset by climatic conditions. No doubt, as inter-communication between the different parts of the Empire advances, cold storage will help to ameliorate the want of good meat to some extent; but in the meantime it is a serious factor in producing a tendency to disease.

*Alcohol* is a curse in the Tropics as at home, and its effects on the economy are even more pronounced in a warm than in a temperate climate. The total abstainer has an enormous advantage in the Tropics from the point of view of health; and everyone who tastes alcohol in any shape before the sun goes down is certainly injuring his health.

Another point I would warn insurance offices against. One of the most trying periods in the life of an old tropical resident is the first year or two after he returns to take up permanent residence at home. Many men with the "tropical mask" upon them throw it off after a year or two. The parchment-like skin and the yellow tinge of the features pass away, and he rejuvenates wonderfully. But a certain number do not do so; fever hangs about them, chronic diarrhœa, &c., develops. Were I to advise an insurance office, I would say, continue the extra premium for a period of twelve or eighteen months after their "life" has returned to Britain, or, unless under medical certificate of fitness, re-impose it should the extra premium have been rebated whilst abroad.

*The Duty of Insurance Companies to the Empire.*—Many of our large insurance offices tell me that they do not care to insure men going abroad to our colonies and dependencies. The business they desire is local, and most of them look askance at "lives" dwelling out of the British Isles. I do not consider this—what shall I say?—patriotic (for want of a better word). I know the business men in insurance offices will scout any such idea as being chimerical, even quixotic; they hold that they are private companies doing their best for their shareholders, and patriotism has no part in their dealings. Like the shipping companies, who will sell their rights to benefit the shareholders, even if the line of ships are lost to the flag; so in the case of the insurance office the money passes into other pockets. In this we cannot altogether blame them, but I think the insurance companies of the country owe a certain duty to the State. They are allowed to accumulate vast sums of public money, and the State has a right to know that they are acting in the interests of the

people. We are an Empire of scattered units, and the communication becomes more and more year by year. Business firms of any pretensions have their branches—or ought to have, if the foreigner is to be kept out—in some one or in several of our colonies. Intercourse with our colonies is the essence of Imperialism, and everything possible should be done to foster it. How, then, do these great public bodies, to whom so much of the nation's money is entrusted, play their part? One company, with the word "Colonial" prominent in the name of the firm, write me that they "do not encourage insurance business with men proceeding to our colonies." Another of the largest of our companies writes me in the same strain; and all, except a very few, look askance at business with persons proceeding abroad. I think this is a serious reflection on any British insurance company. Think what it means. There is scarcely a family in this country that has not a near relation or several relations residing abroad. The majority of insurances is taken out by the middle classes in Britain, and it is from the middle classes that our business firms are supplied with men, and from which our Army, Navy, and Colonial officers are drawn. The number of near relations (I go no further than brothers, sisters, or first cousins) residing abroad number tens of thousands, and to almost each one of these an obstruction is placed to their going by insurance companies. If the insurance companies are to take their place in the imperial work before us, they must cease to be parochial in their notions and to remember that the State, having allowed them to accumulate a large part of the national wealth, requires of them national work. What is the consequence of their desire to "ca' canny"? The American companies step in. Soon after an uninsured Britisher sets foot in a colony, the omnipresent American insurance agent makes overtures, and more often than not secures a policy. The money goes to swell American coffers, and the British office—that is, Britain—is left all the poorer. And all this for what reason? Because British insurance offices have based their opinions as to the danger of modern life in the Tropics on "gossip" of fifty years ago, and they affect to believe in dangerous and unhealthy areas of the globe on insufficient evidence.

*The Insurance of Natives.*—The question of insuring the lives of natives remains a vexed one. British offices, for the most part, do not push this business; American insurance offices do. I am not prepared to give you a statistical table of the expectancy of life of, say, a Hindoo, Malay, Chinaman, or negro: no statistics are available; but I am prepared to give advice in regard to the matter. The question narrows itself down to a very fine point. It is only the more advanced and intelligent of the natives of any Asiatic country who take out insurances on their lives. It is the natives who have become "Anglicised" to a greater or less extent that usually come forward for insurances. But in the process of becoming Anglicised they have acquired more than an imperfect knowledge of English and of British habits in business; they affect British ways of living to some extent, and especially do they take to the food and drink which they see supplied to the British table. Beef and mutton take the place of fish or fat pork in the diet, and European wines, especially champagne, are the constant concomitants of, say, the Chinaman who takes to European "chow." A rich Chinaman who affects the European mode of living has his Chinese "chow" with his family, and European "chow" (it may be immediately afterwards) with his Anglicised male *confrères*. The excess of rice at one meal, with beef, &c., and sweet champagne—the sweeter the better he likes it—in time tells its tale. Gout, kidney and liver troubles supervene, and his days are shortened. It is from this very class that most native lives are insured, and they are the very worst lives of the land they belong to. The ignorant and simple living native might be as good a life as any European—as a matter of fact he seldom is—but when he departs from his simple habits, and takes to "foreign" ways of eating and drinking, his life is not a good one. I saw much of American methods of dealing with the Chinese in regard to insurance. At one time, in Hong Kong, the Chinese insured largely in American insurance offices, but during the last years of my stay there they almost ceased doing so. Perhaps they have taken it up again, but I hope on a different footing to that which was in vogue when I knew the methods followed.

*The Effect of Rapid Communication.*—The present rules and opinions which guide insurance offices in their work must have been—many positively were—formed when communication between Britain and her colonies was wholly or mostly by sailing vessels, and when railways in the interior of these possessions were unknown. These days, fortunately for tropical residents, are gone. When they fall ill the railway can convey them from the plains to the hills, and rapid communication by sea allows of a speedy change of climate either to home or to some salubrious spot. The extra-premium insurance charges are no doubt a considerable source of income and profit to our home insurance offices, and by laying them aside a loss might be entailed to the companies. What they lose, however, in this direction will be a gain in another and more useful manner to them and to the finances of the country generally—namely, by removing obstacles founded on an obsolete opinion, and encouraging young men to insure their lives in British in place of in foreign offices.

*The Medical Officer of the Company the only Reliable Adviser concerning Tropical Lives.*—I would recommend British insurance offices to rely for advice as regards the value of the lives of tropical residents on the medical officers of their companies, and not on their actuaries. The actuary cannot know, he has no means of knowing, the effect of climate or the local state of healthfulness in any individual colony. The figures to his hand are misleading; the birth-rate is often far below the death-rate, and yet the population of the colony advances by leaps and bounds. The explanation of this is simple enough—namely, the importation of men—of coolies—labouring men in particular—who leave their wives and families in their native land. There are but few British colonies in which a native race can be studied as to its vital statistics with any degree of usefulness. In Crown colonies, I might say all Crown colonies, the importation

of male native labour upsets the balance of the male and female population. The children are not born in the British colony, the men when they get ill leave the colony, so that neither the birth-rate nor the death-rate give any indication of the normal. I naturally do not know every colony, but in most the instability of the population is a prominent feature, and the influx of young healthy men cannot possibly in any way help the actuary in coming to a conclusion, except an erroneous one, should he venture to base his knowledge on local statistics. Medical men are the best, I may say the only reliable authorities on this subject. I would suggest that a central medical committee of reference should be elected, who, collectively, would be able to decide what risk is entailed by a client of any insurance company proceeding abroad. It is impossible for any one individual to know the exigencies of climate in every sphere, but a committee of experienced men have means of ascertaining with some degree of precision what these really are. This advice I tender, not from interested motives, for I am not a member of any society, nor do I hold the post of medical officer to any insurance company, nor am I ever likely to be asked to do so, in view of my strongly expressed opinions concerning the duty of British insurance agencies in this country. I, therefore, have no axe to grind, except to do what I can for many persons on whom the extra premium presses hardly and unjustly; and to attempt to stimulate the insurance offices of Great Britain to realize their duty to the State by ceasing to hinder the unity of the Empire by callousness in their business, or by placing obstacles in the way of inter-Imperial intercourse.

**"Journal of the American Medical Association," December 24, 1910.**

Sutton, of Kansas City, describes further cases of sporotrichosis in America. The infection gets into slight open wounds on the hands and arms of farmers and others of similar occupation. The wounds then prove resistant to ordinary surgical treatment, and one or more sharply circumscribed, painless, cutaneous or subcutaneous abscesses develop along the course of the limb, the manifestations of typical streptococcic cellulitis being absent. The specific organism is not always easy to find, and as the lesions often closely resemble those of tertiary syphilis and heal promptly under antisyphilitic treatment, many of the cases are incorrectly diagnosed.

**"West London Medical Journal," January, 1911 (No. i, vol. xvi.).**

McDonagh, in a paper entitled "Practical Experience with Ehrlich's New Specific for Syphilis," describes the result of an injection of "606" on a case of human trypanosomiasis. The patient was a case of Sir Patrick Manson's at the Tropical School of Medicine, and had contracted the disease in Rhodesia. Atoxyl, arsacetin, and antimony had been used previously. One injection of "606" was given intramuscularly; the blood remained free from trypanosomes for three weeks, but after that time the parasites returned again. McDonagh believes a better result might have been obtained if the drug had been given intravenously.

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THE JOURNAL OF

# Tropical Medicine and Hygiene

FEBRUARY 1, 1911.

## YELLOW FEVER IN WEST AFRICA.

THE occurrence of yellow fever in West Africa has been known for the last hundred years and more, though epidemics there have not attracted so much attention apparently as similar ones in the West Indies and South America. The most recent one, that of last year (1910), has been brought more prominently before the public however, chiefly by Sir Rubert Boyce, who recently read a paper on the subject before the Society of Tropical Medicine and Hygiene, in which he claimed that the disease was endemic on the coast of West Africa. This assumption quickly raised an animated discussion (abstracts of which appear to-day, and have been appearing in the JOURNAL OF TROPICAL MEDICINE AND HYGIENE for some time past) in the above Society, many of its members objecting somewhat strongly to the idea of the endemicity of this disease in the different colonies of the West Coast. After all, the matter would seem to rest on what one means by the word endemic. If Sir Rubert Boyce had modestly claimed that French Senegal and perhaps one or two other places in West Africa were endemic foci of yellow fever, few, if any, would have disagreed with him, but, unfortunately or fortunately, as the case may be, he played a bolder hand, and stated definitely that the disease was generally endemic on the whole coast of West Africa,

the reservoir of the infection being mild, unrecognized cases amongst the natives or white inhabitants. If such were the case, one would naturally expect all new-comers to quickly acquire the disease and with such an acquisition there would be many deaths, as in other endemic areas; and some of these would show the typical clinical signs of yellow fever. Drs. Chichester and Prout, both of whom have had a large West African experience, are equally emphatic, however, that such a state of affairs does not exist and such an expression of opinion must be treated with respect. The real crux of the situation, at least up to the present time, has been the diagnosis of real yellow fever cases from cases of malignant malaria, and many of the former have been diagnosed as the latter, and *vice versa*, in every part of the world where both exist. The supporters of the general endemicity of the disease on the Coast have considerably weakened their position by a somewhat unjustifiable attempt to make out that all cases of bilious remittent malaria have really been cases of yellow fever, and have been wrongly diagnosed. Such a contention will not hold for a moment, because cases of bilious remittent fever occur in malarial areas where there has never been yellow fever, and their true nature has been amply proved by the finding of the specific parasites during life, and by the typical *post-mortem* appearances after death.

Clinically, it is true, there is often the greatest difficulty in saying whether a case is malaria—especially, of course after quinine has been taken—or yellow fever, and often it may practically be impossible to tell. None of the signs of yellow fever usually described in books, with the exception of Faget's sign, may hold good in many cases in the differential diagnosis. The ferrety eye, the epigastric pain, the jaundice, the bilious vomiting, the albuminuria, the appearance of the tongue and the temperature, will not distinguish between some cases of malaria and some of yellow fever, at least early enough to definitely allow of a positive diagnosis being given; and all that there is to do is to wait. A typical case may come along with black vomit then, or a case may die, and here lies the solution of the mystery. Little or no stress seems to have been laid on the definite diagnosis of yellow fever and its definite differentiation from malaria by *post-mortem* examination during the discussion at the Society of Tropical Medicine and Hygiene just mentioned, and the omission of this cannot be too strongly deprecated. There seemed to be more a tendency to theorize on the past than to descend to the realms of fact of the present time. After all, the histories of past cases, though interesting in some ways, are absolutely useless for purposes of statistics, unless proper autopsies were performed by competent persons upon them, and this seems hardly ever to have been done. Dr. Harford's series of cases is a case in point. Autopsies on them would quite as likely have revealed malaria as yellow fever. It is not necessary to enter into the pathological changes found in the two diseases here. The appearance of the liver and kidneys and the typical black vomit in the stomach in yellow fever are totally dissimilar from the pathological changes found in malaria and the only difficulty that can occur is in the case where the former disease has been superadded on the latter, a not altogether uncommon occurrence in countries where malaria is rife. A pathologist of some standing should therefore be called in to decide, when his presence is available. The question of the general endemicity of yellow fever on the West Coast of Africa will be settled, then, by study in the future, not by the study of the past. What is required for the future is *post-mortem* examinations by competent persons on all cases of suspicious deaths, or, better still on all deaths, whether suspicious or not, so that the actual cause of death—malaria, yellow fever, or otherwise—may be accurately recorded. Until this is done we should hold the question of the endemicity of the disease in West Africa *sub judice*. This question—what Sir Patrick Manson referred to as Professor Boyce's hypothesis—is of much too great a magnitude for the Government to act upon until the matter is proved definitely up to the hilt, and therefore a Governmental enquiry is urgently required to carefully study the matter as it exists now, and as it will exist in the future, so that eventually some finality on the subject may be reached, and a proper plan of campaign adopted.

G. C. L.

## Abstract.

### THE DISCUSSION ON THE DISTRIBUTION AND PREVALENCE OF YELLOW FEVER IN WEST AFRICA AT THE SOCIETY OF TROPICAL MEDICINE AND HYGIENE.

(*Continued.*)

Professor W. J. Simpson said that Sir Rubert Boyce had done good service in West Africa in drawing attention to the presence of yellow fever on the coast, and to its not infrequent prevalence. Few realized that yellow fever was a disease which counted in the causation of the periodic unhealthiness of West Africa. There was ample evidence of the prevalence of yellow fever on the mainland of the West Coast of Africa during the past 150 years, just as there was evidence that it did not exist there before that period. Both Augustin's and Finlay's works showed that yellow fever existed in America before the advent of Columbus, and the disease did not appear to take root on the mainland of Africa till 1759, where it first affected a lodgment in St. Louis at the mouth of the Senegal river, which was then in the possession of the English, and from there it spread three years later to the Gambia and next year to Sierra Leone. A table giving a summary of yellow fever years and periods of immunity in Africa for the last 400 years was then shown — this table, Professor Simpson contended, showed that yellow fever was endemic on the West Coast of Africa in the sense that it no longer required importation from the original cradle of the disease to set up an epidemic. It did not exclude importation from America when there was communication, but it recognized that in West Africa there might be places, like Havana used to be in Cuba, or Vera Cruz in Mexico, from which infection might be carried to

other places, and from these latter to others which might be healthy—this was one view of endemicity, and it exonerated the greater part of the coast from yellow fever except on the occasions when the disease was carried there. The other view of endemicity held by Sir Rubert Boyce was, that the native children suffered from mild attacks of yellow fever, and that for Europeans the acclimatization fever of West Africa was a mild form of yellow fever, which in the more pronounced cases were bilious remittents, and in the malignant forms showed the classical symptoms of yellow fever, accompanied with black vomit. Possibly this latter view might be right, but there were at present no important facts to support it as far as West Africa was concerned, and at the most it could only be a working hypothesis for a commission of enquiry. Professor Simpson thought that there was a difficulty in coming to a conclusion owing to there being no death certification of natives. The existence of course of *Stegomyia calopus* in West African towns indicated the risk which was likely to arise should the infection of yellow fever be imported, rather than a proof that yellow fever existed in a mild form. The figures given by Sir Rubert Boyce and himself, although showing a remarkable persistence of the disease on the West Coast of Africa needed analysis before a conclusion could be arrived at.

A table taken from Augustin's work showed the localities in West Africa which had been visited by yellow fever. While some places such as Sierra Leone, Senegal, Canary Islands, Cape Verde Islands, and the Gambia had had frequent visitations, others such as Calabar, Lagos, Madeira, St. Thomas and Dahomey had only been affected once or twice. It was fairly obvious then that those latter localities that had been affected but seldom could hardly be considered to have the disease in an endemic form. If one went on the figures alone it would be equally correct to say that the Canary Islands were endemic areas of yellow fever. In reading the history of the more important outbreaks on the coast, the impression borne in on Professor Simpson was the frequency with which the disease was traced to importation from a previously infected centre.

As regards the independent origin of yellow fever in 1910 in Sierra Leone, Sekondi, Saw Mills, and Axim, the dates on which they occurred admitted of the infection having been carried to them from an infected place. The Saw Mills, in which one case occurred, was only twelve miles up the railway line from Sekondi, and Axim was only a four-hours' voyage from Sekondi, or less than two days march by land. Much importance had been attached by Sir Rubert Boyce to the production of mild cases of yellow fever by the experiments of Dr. Finlay and the American Commission, but 18 per cent. of very mild cases still left 82 per cent. of distinctly typical cases. It was to be remembered that Carroll, who allowed himself to be bitten by a single mosquito, nearly lost his life by the severity of the attack of yellow fever that this single mosquito produced; and Dr. Lazear, of the Commission, died of an attack of yellow fever. Professor Simpson then quoted from Professor Patton, of New Orleans, who, discussing those experiments, once said that when sufficient proof of the conveyance of infection by the bites of mosquitoes had accumulated to satisfy the most sceptical, experiments on human beings were discontinued, as being attended by risk of life, even when most carefully conducted. Continuing, Professor Simpson said that if yellow fever was the acclimatization fever of West Africa, it meant that every European had a mild attack of yellow fever contracted from native children or from his European friends, much in the same way that he got infected with malaria when not protected with quinine. It was strange, if this were so, that no fatal cases of yellow fever, or even typically mild cases, presented themselves on the Coast for years. If one observed the behaviour of yellow fever in a town such as Vera Cruz, where the disease had been endemic for centuries, where the population is not large, and where immunity by mild attacks or recovery from severe ones must play an important *rôle*, one would at once see that it was different from that which characterized the yellow fever in the towns of West Africa, in which Sir Rubert Boyce held the disease was endemic. In Vera Cruz, the immunity produced by its continuous presence did not prevent a yearly prevalence and a large number of deaths. In other words, it behaved like other diseases in an endemic town. Possibly there might be an acclimatization fever in West Africa, but there was no reason to suppose that this was yellow fever any more than any of the other unclassified fevers. One important fact was that the Medical Department of the Admiralty had furnished him (Professor Simpson) with a list of the yellow-fever cases that had occurred in the Navy since 1880; and he found from this list that though there had been small outbreaks of yellow fever in the warships in the West Indian stations, there had not been a single case of yellow fever on any of the warships on the West African Coast during the thirty years that had elapsed. The crews had suffered from malarial fever from the vessels lying in the creeks and rivers, but there had been no case of yellow fever, or suspicious cases, and this though the crews had been subjected to the bites of the *Stegomyia*, both on board ship and on the land. This was a very different history from the early period of the 19th century, when the hunting for slavers was active, and when the prize crews were brought to Sierra Leone.

It was from this early period that Sir Rubert drew his illustrative cases, and there could be little doubt, then, that yellow fever was endemic in Sierra Leone, and it was recognized also that during an outbreak there were mild cases of yellow fever, as well as the more numerous fatal cases. The question at issue now, however, was: Was Sierra Leone still an endemic centre, and were the coast towns endemic centres now, or had they ever been?

The outbreak at Sekondi lent support to the view of newcomers being more liable. The first suspected case of yellow fever had only been nine days in Sekondi, and the two longest seven and fifteen months respectively. A different interpretation from acclimatization had however to be put on this, for, as a matter of fact, the majority of those attacked and who died had been on some part of the Gold Coast for years and were attacked because Sekondi had recently become infected. In concluding, Professor Simpson

said, that the question raised was so important that it was one well worthy of a Scientific Commission to thoroughly investigate. It was one that could not be left as it was, and ought to be investigated.

Dr. C. W. DANIELS said, that one of the chief difficulties lay in the distinction between mild forms of bilious remittent fever and mild forms of yellow fever. The differential diagnosis of severe forms was easy. It seemed to him that it was a common error to assume that bilious remittent fever was a mild fever, ranking in severity somewhere between malaria and yellow fever. Bilious remittent fever was often a very severe form of fever more dangerous even than blackwater fever. Amongst the cases mentioned by Sir Rubert Boyce some had not one single characteristic symptom of yellow fever and possibly were not that disease at all. The occurrence of mild forms of yellow fever had always been recognized, so that this was no new discovery, cases of the kind having been reported for the last one hundred years. The prevalence of fever amongst natives, at times when yellow fever was present, had also been commonly known. As regards Sir Rubert Boyce's contention that yellow fever was endemic in West Africa the author had stated that outbreaks were simultaneous in several places, and asked how this could be explained except by assuming that the disease was endemic in Africa. He, Dr. Daniels, thought that the true explanation lay in the fact that no one could tell when an epidemic began or when it ceased. In any case, the simultaneous character of the outbreaks in various parts had not been proved. One could not, of course, object to Sir Rubert Boyce advancing his hypothesis had there been any adequate foundation for it, but, unfortunately, he appeared to have brought it forward without proper consideration or thorough realization of the serious effects which would logically follow were it adopted. For instance, if yellow fever were to be considered endemic throughout West Africa—and on similar grounds throughout the West Indies—this would mean that in every country where *Stegomyia* existed and no yellow fever, a permanent quarantine would have to be established against these two areas.

This would completely shut off West Africa and the West Indies from the rest of the tropical and subtropical world, and the Canaries, the only health resort adjacent to West Africa, would refuse to allow patients to land from that part. Moreover, if, yellow fever were declared to be endemic throughout West Africa, every administrator would ask, "Why take any trouble about quarantine at all? What was the good of quarantining against Sierra Leone if the disease was endemic in his own town or if the disease was always present among the native children? This was a disastrous issue to contemplate. Quarantine had always been our first line of defence against yellow fever. By all means exterminate *Stegomyia* if possible in the same way as one would rats to prevent the spread of plague, but other methods were not to be neglected. Dr. Daniels attached so much importance to the question of the endemicity of yellow fever in West Africa, especially in view of the fact that Sir Rubert Boyce's statements had appeared in the lay press, that he thought it was imperative that the Society of Tropical Medicine and Hygiene should give an expression of its views and state whether or not it supported Sir Rubert Boyce's theory, and this more especially for the sake of those who might hereafter be called upon to take practical action in the prevention of yellow fever.

(*To be continued.*)

## Report.

### DURBAN CORPORATION MEDICAL OFFICER'S ANNUAL REPORT FOR THE MUNICIPAL YEAR ENDING JULY 31, 1910

DR. P. MURISON, Medical Officer of Health for Durban, in his annual report for the municipal year ending July 31, 1910, states that during the municipal year just ended there have been marked evidences of returning prosperity, and one of those signs has been a notable increase of population in the borough. The Chief Constable's returns show that in 1908 there were 500 empty houses in Durban; in 1909 these had been reduced to less than 50, while the number of dwelling-houses erected has not been inconsiderable.

In addition to the settled population of the borough, there is now a large influx of visitors during the winter months, and although the actual figures are not available, a safe estimate would be that the population at any time during June, July, and August is increased by 6,000 persons. The ideal winter climate is now being fully recognized and widely known, and with facilities for enjoyments of all kinds, the result has been that every available room for the accommodation of visitors is booked up months in advance. These conditions will soon right themselves naturally, but at present they constitute questions of some public concern. The idea that the winter months are the only ones possible in Durban for health is fast disappearing, and the season for visitors equally includes autumn and spring months as well.

The birth-rate is somewhat lower this year than last, although the number of births is practically similar. The European death-rate has fallen to 6·6 per 1,000 inhabitants, probably the lowest recorded death-rate, with accurate figures, of any community the size of Durban. The whole question of a death-rate of this remarkable nature is dealt with in detail when considering the vital statistics of the borough. Briefly, however, the point is this—a death-rate low or high—in the absence of any special circumstances, is essentially a question of the ages of the people constituting the community. At the extremes of life the death-rate is very high, but at ages say from 5 to 45 years the death-rate is extremely low. If two towns are being compared and one has a greater proportion of its inhabitants between those ages, if all other conditions are equal, it should have a lower death-rate than the other. It can easily be seen that in certain circumstances a death-rate of 6·6 per 1,000 might even be excessive.

During the past year infant mortality has diminished very much, but such a result cannot altogether be claimed as due to the efforts put forth on the part of

the Health Department. The diminution has been chiefly due to a decrease amongst diseases of the alimentary tract, showing that more careful feeding is apparently being carried out. The infantile mortality rates show that after the first year of life is past the liability to death is very slight. The importance on the part of the mothers of knowledge of infant life in order to guard their little one during the first twelve months is of supreme moment. No recognized teaching is given, and many mothers have to find out by experience only—this experience being often at the cost of the life of their infant.

The primary object in providing a Municipal Public Health Department is to *prevent*, and not merely to deal with outbreaks or epidemics of infectious diseases when they occur. The time is fast coming when it will be considered a sign of weakness in a well-governed town for any disease to assume epidemic proportions. It is already recognized as the duty of municipal authorities to maintain a skilled staff in constant activity, searching for any cause or causes likely to deteriorate health, and ready to deal with any primary cases of infectious diseases in so efficient a manner as to prevent the spread of infection from them to the healthy members of the community.

Judged by such considerations it can be said that as no outbreak epidemic, special sickness, or mortality has occurred in the borough during the past year, the Public Health Department has successfully carried out its duties.

Dr. Murison further states that it is gratifying to be able to record that not only the medical practitioners, but the burgesses, are displaying interest in, and anxiety for, the assistance of the Department when an infectious disease occurs in their households, and it may be remarked that demands are fairly common for assistance in connection with diseases other than those generally recognized as infectious. Any influence which affects or threatens to affect the health or comfort of the inhabitants of a borough is a matter of concern to a public health department. The commencement of such work on systematic lines was the means of producing considerable annoyance amongst some people when visited by officials connected with the Department, but doubtless owing to the tact displayed and assistance rendered this feeling has been entirely overcome.

As regards the death-rate already mentioned, the greatest decrease has been amongst the Asiatic population, where the death-rates have fallen from 37·9 per 1,000 in 1905-06 to 17·0 per 1,000 this year. Going somewhat further back it may be pointed out that in 1902 the Indian death-rate of this borough was equal to 57·0 per 1,000 inhabitants per annum. The Protector of Indian Immigrants has recently issued his report for 1909, and gives the death-rate for Indian immigrants throughout Natal for 1909 as being equal to 15·28 per 1,000 of such inhabitants.

Amongst Europeans during the past five years the death-rate has diminished from 10·9 to 6 6 per 1,000. The diminution of the death-rate commenced from 1903, and has been largely influenced by the practical eradication of enteric and dysentery.

The native death-rate has also diminished, although not to a very great extent.

In the case of natives attention has previously been drawn to the fact that the figures published as to the death-rates of the native population of Durban cannot be accepted as a true reflex of their mortality as inhabitants of this borough. Death-rates are calculated on the population and the number of deaths amongst such population, and the result is returned in terms of per 1,000 population per annum. So far as the native population of Durban is concerned a glance at its sex distribution is sufficient to show its unnatural composition. Out of a total population of 16,489 there are 15,674 males and 815 females. This artificial constitution of a population shows what we really know, namely, that the native is only a temporary inhabitant of this borough and from reliable information the average length of this temporary residence is under, rather than over, six months. There is naturally, however, a native population constantly maintained in the borough by such temporary sojourners.

As regards native deaths occurring in the borough, inaccurate results are obtained by calculating such returns in the usual way. When a native becomes ill he prefers to return to his kraal and get treated by and amongst his friends—the offer of hospital treatment is not readily accepted. When a sick native prefers to go home his employer generally does not and cannot offer any serious objections, and as this custom is not confined to natives working in Durban it is reasonable to believe that many natives die at their kraals of diseases contracted elsewhere, but no information as to the place of origin of such fatal diseases amongst natives is available. Many of the native deaths occurring in Durban are doubtless the result of the inability of the patient to get away to his home, in some cases because of the suddenness and severity of the attack of illness, and in many other cases from pecuniary reasons. The Health Officer in Natal in his report for 1909 gives the general native death-date for the Colony of Natal as being equal to 17·37 per 1,000 of the native population. In Durban for 1909-10 the death-rate as obtained is equal to 5·4 per 1,000 of the native population of the borough. It will be noticed that out of a total of 88 deaths last year 15 were deaths from accidents and 10 were still-births, these two causes alone accounting for over 30 per cent. of the total native deaths, causes which would prevent return to their homes.

With such a steady and considerable diminution in the total number of deaths per annum since 1902 one naturally first inquires as to whether there has been any considerable diminution in the population of the borough. The Borough of Durban probably reached its highest population about the end of 1903. From that time it decreased rapidly for two or three years and much more slowly subsequently. This decrease continued till 12 per cent. of the total population had left. Regarding this exodus it was shared in nearly equal numbers by the European and native populations, the Indian population remaining almost steady. A decrease of 14 per cent. of the European population and a decrease of 17 per cent. amongst the native population does not proportionately account for the reduction of numbers of deaths and death-rates. The

real reasons are: The vast improvements and extensions in municipal works bearing on public health; a higher standard of general sanitation throughout the borough, and the maintenance of better hygienic conditions in and around human habitations and places of work. Of recent years there has obtained a higher standard of domestic dwellings and corresponding increase of social conditions, together with the elimination from the borough of two such well-recognized filth diseases as enteric and dysentery. The condition of Durban, compared even with that of six or seven years ago, has become now much more settled and consolidated, and at least the European population may be regarded as consisting of persons permanently domiciled. Dr. Murison is also inclined to believe that the recent commercial depression resulting in many cases in reduced incomes has been the means of compelling many families to live a simpler life so far as food and drink are concerned, and has not been without its good effect.

During the past five years the borough has not been free from epidemics or outbreaks of infectious diseases. They have, however, all been controlled and prevented from more than slightly affecting the death-rate, chiefly on account of the readiness with which necessary supplies have been voted in order to effectually deal at the commencement with whatever seemed to threaten or affect the public health of the borough.

During the past year no cases of plague or smallpox have appeared within the borough, nor has any case of malaria had its origin within the boundaries of Durban. Dysentery is now rare, or does not exist; enteric is diminishing rapidly, and only nine cases of scarlet fever were notified in the last twelve months. Diphtheria, on the other hand, has shown an increase, and there has also been a considerable number of cases of whooping-cough, the same holding good for measles. Tubercle, as in other places, is a problem earnestly requiring solution.

During the year the following examinations were made in the laboratory attached to the Public Health Department:—

| | Positive | Negative |
|---|---|---|
| Tubercle bacilli | 35 | 102 |
| Diphtheria bacilli | 7 | 29 |
| Widal reaction for enteric fever | 4 | 27 |
| Malaria | 0 | 6 |
| Gonococci | 2 | 4 |
| Pneumococci | 0 | 2 |
| Ankylostomes | 1 | 1 |
| Bilharzia | 1 | 2 |
| Hydatid hooklets | 0 | 1 |
| Cerebro-spinal meningitis | 0 | 1 |
| Streptococci | 0 | 1 |
| Totals | 50 | 176 |

*Total Examinations.*

| 1903-4 | 1904-5 | 1905-6 | 1906-7 | 1907-8 | 1908-9 | 1909-10 |
|---|---|---|---|---|---|---|
| 872* | 14,936* | 12,898* | 5,919* | 137 | 187 | 226 |

* Chiefly plague examinations.

By-laws against offensive trades have also been adopted, and by the reasonable application of these Dr. Murison hopes to be able to maintain the reputation of Durban as an industrial centre as well as being one of the cleanest and healthiest towns in the southern hemisphere. Dr. Murison must certainly be congratulated on the excellent results he has been able to narrate in his very interesting report, and it would appear if the progress mentioned is kept up, that the claim of Durban to be considered one of the healthiest of towns cannot be denied.

## Drugs and Appliances.

PARKE, DAVIS AND CO., Beak Street, Regent Street, London, W.—The Glasmet syringes are constructed solely of metal and glass, and are eminently suitable for the injection of serums and vaccines, as well as for exploratory purposes. A useful innovation is that the whole of the parts of the syringe can be sterilized in its own case. Practitioners in the Tropics would do well to specify that this syringe is sent to them with platino-iridium needles, and not with steel needles. Nothing could be handier than the hypodermic pocket case with drugs and syringes complete, sent out by this firm.

MESSRS. OPPENHEIMER, SON, AND CO., Queen Victoria Street, London, have issued the following preparation: "Grindeline," containing a liquid extract from *Grindelia robusta* (not *G. squarrosa*), which is a useful accessory in the treatment of asthma. The other ingredients of "Grindeline" are potas. iod., trinitrin, and tinct. euphorbia pilulifera. The preparation is a cardiac sedative and an expectorant, and may be taken internally in asthma, and in all varieties of respiratory spasm.

HYODIN has been brought out by Messrs. Christy and Co., 4-12, Old Swan Lane, London, E.C., as a useful preparation in acute and chronic rheumatism.

MESSRS. C. J. HEWLETT AND SON, LTD., Charlotte Street, London, E.C., have introduced several remedies for so-called winter ailments which are both efficient and agreeable.

(*a*) Elixir aceto-salicylic acid in 2 to 4 dr. doses—in rheumatism and as an antipyretic and analgesic.

(*b*) Tinct. heroin rub., 1 to 2 dr.—cough and bronchitis.

(*c*) Tinct. tussis nig., ½ to 1 dr.—cough.

(*d*) and (*e*) Mist. tussis alkalina 1 dr., and mist. tussis rub. conc. 2 dr.

(*f*) Mist. pectoralis infant, ½ to 2 dr.

(*g*) Syrup. mellis co, 1 to 2 dr.—cough (contains no opiate).

Several preparations containing thymi, mist, heroin et thymi co, and mist. thymi co, in 1 to 2 dr. doses, are excellent.

MESSRS. OPPENHEIMER, SON, AND CO., 179, Queen Victoria Street, London, have issued under the name of Boehringer's preparations: (1) Ceridin—the active principle of yeast—useful in acne and furunculosis. (2) Diplosal—a salicylic preparation—used in some cases as salicylic acid, but is less irritating to stomach. (3) Ferratin—a combination of albumin and iron. (4) Filmaron—the active principle of male fern—useful in tænia, ankylostomiasis, &c.

The Hoffman-La Roche Chemical Works, Ltd., of Idol Lane, E.C., a branch of F. Hoffmann-La Roche and Co., manufacturers of chemical products, Basle, Switzerland, and Grenzach, Germany, have recently placed some new drugs on the market.

*Thigenol.*—This is a synthetically prepared sulphooleate containing 2·8 per cent. of organically fixed sulphur. It is freely soluble in any proportion in water, glycerin, and dilute alcohol, and also mixes well with lard, vaseline, collodion, &c. When applied to the skin it forms a non-sticky coating which can easily be removed by washing. The drug, which is non-toxic, is used in skin diseases such as eczema, acne, impetigo, psoriasis, scabies, seborrhœa pruritus, and also in some diseases of women, such as cervical catarrh and leucorrhœa.

*Airol.*—This is a greyish-green powder of low specific gravity; odourless, tasteless, and not affected by light. It is insoluble in water, alcohol, and ether. It is an antiseptic, exsiccant and astringent, and it is used similarly to iodoform for wounds, ulcers, burns, tuberculous cavities, &c.

*Omnopon.*—This is a preparation of opium containing the total alkaloids in the form of hydrochloric salts. It was prepared at the suggestion of Professor Sahli, of Berne, who desired the use of a drug which, having the same action as opium, as distinct from morphia, would yet be soluble in water, and therefore lend itself to hypodermic medication. As regards dosage, Sahli recommends as an average dose, $\frac{1}{5}$ gr., or about double that of morphia. "Omnopon" can also, however, be administered as a powder or in the form of tablets, or may be added to mixtures, such as cough or diarrhœa mixtures, &c. For subcutaneous injection $\frac{1}{3}$ gr., or 1 c.c. of a 2 per cent. solution in sterile water and glycerin, can be administered. For the latter purpose sterile ampoules have been prepared. They are standardized to contain 1·1 c.c. instead of only 1 c.c., to enable an accurate withdrawal and administration of a full dose in spite of the unavoidable waste due to adhesion of some of the fluid to the walls of the ampoule and to the hypodermic syringe.

## Annotations.

*New Species of Glossina.*—Mr. Robert Newstead, in the Annals of *Tropical Medicine and Parasitology*, December 20, 1910, describes three new species of the genus *Glossina*, and gives a description of the hitherto unknown male of *Glossina grossa* (Bigot). The discovery of the three new species, the author tells us, was brought about by an examination of the morphological characters of the genital armature of the males. The application of this test to some dark forms of tsetse flies at the Liverpool School showed that they were structurally distinct from specimens of *G. morsitans* from Rhodesia, and therefore the author believes they should form a new species, for which he proposes the name *G. submorsitans*. A further extended examination of the genital armature of the males of all the other known species of the genus *Glossina* reveals the fact that there are four distinct species of that group of tsetse flies, of which *G. fusca* may be taken as a type, these being *G. longipennis*, *G. brevipalpis*, *G. fusca*, and *G. grossa*. The author, however, states that Mr. Austen, the great authority on tsetse flies, believes the latter, *G. grossa*, to be identical with *G. fusca*, and he, Mr. Austen, considers that the name should disappear, or be sunk as a synonym of *fusca*. On the other hand, Mr. Newstead believes that there are no structural differences between *G. palpalis* and the variety *Wellmannii*; and, therefore, that that name should disappear. The other new species described by Mr. Newstead, *G. submorsitans* being the first, are *G. brevipalpis*, which the author states can easily be recognized from *fusca* by its shorter and stouter palpi, its generally paler colour, and its somewhat indefinite thoracic markings, and *G. fuscipes*, recognizable from *G. palpalis* by its much smaller size, by the uniformly infuscated or dusky legs, and the dusky grey thorax. The genital armature of the latter resembles that of *G. palpalis* and *G. tachinoides* in its general form, but the shape of the superior and inferior claspers are markedly distinct from those of either of these insects. The only example of this interesting tsetse fly, the author states, was taken by Dr. Shircore at Niinule, Nile Province, Uganda, and fortunately proved to be a male, as otherwise it might have passed as a small dusky form of *G. palpalis*.

*Another New Species of Tsetse-fly.*—Mr. Austen, in the *Bulletin of Entomological Research*, vol. i., part 4, January, 1911, describes a new species of tsetse-fly, which he names *Glossina caliginea*. The species is allied to and resembles *G. palpalis*, but is browner and usually somewhat larger. The head is broader, the front if anything being narrower, at least in the male, and the dark portion of the dorsal surface of the abdomen is a dark sepia-brown instead of clove or blackish-brown. Up to the present the species has only been met with in Southern Nigeria, and it is said to be specially prevalent in the month of May, when it is very liable to attack travellers in canoes. Four species of tsetse-fly now come into the group with dark hind tarsi, constituted by *G. palpalis*, *e.g.*, the species just named, *G. pallicera*, *G. caliginea*, and *G. tachinoides*. The new species, Mr. Austen says, can only be confused with the first two. Mr. Newstead, of the Liverpool School of Tropical Medicine, has also recently described some new species of tsetse-flies, so that it would seem as if there was to be a considerable augmentation in the numbers of these pests.

*The Routine Examination of Indian Water Supplies.*—Brevet-Colonel R. H. Firth, R.A.M.C., Sanitary Officer, Army Headquarters, writes in the *Indian Public Health and Municipal Journal* for December, 1910, on the routine examination of Indian water supplies. His remarks are primarily intended for the consideration and guidance of sanitary officers and others engaged in the examination of water supplies in India, and are in no sense to be interpreted as precluding the adoption of alternative methods or the development of initiative on other lines. The author recognizes that the conditions under which

sanitary officers work in India are very different from those prevailing in well equipped laboratories at home; but, making all allowance for these disabilities, he thinks that it is quite open to all to advance on the well-known lines, and to display initiative in this branch of medicine when the occasion arises. As regards the routine examination of water, Colonel Firth hopes that, when time and circumstances permit, the qualitative and quantitative chemical examination will not be omitted, though of course in some cases only the former may be possible.

A minimum examination should embrace qualitatively the reactions for chlorides, lime, ammonia, nitrites and nitrates, and quantitatively the amounts of chlorine, free ammonia and nitrogen, as nitrates and nitrites respectively.

When time permits, the albuminoid ammonia and the organic nitrogen by Kjeldahl's method should also be estimated. The biological examination is equally important, there being much to learn, the author thinks, concerning the fauna and flora of Indian waters.

In all these matters, however, hard-and-fast rules need not be laid down; the difficulties are many, and the necessity for particular estimations in each case must be judged on its merits by the officer responsible.

## Personal Notes.

### India Office.

*Arrivals Reported in London.*—Lieutenant-Colonel J. Shearer, C.B., D.S.O., M.B., I.M.S.; Lieutenant-Colonel J. K. Close, I.M.S., B.; Captain G. D. Franklin, I.M.S., B.; Major A. H. Moorhead, I.M.S.; Captain F. O'D Fawcett, I.M.S.; Major J. C.H. Leicester, I.M.S., B.; Captain D. Munro, I.M.S.; Colonel C. H. Beatson, I.M.S.; Captain D. G. R. S. Baker, I.M.S.

*Extensions of Leave.*—Captain L. B. Scott, I.M.S., B., 14 days; Major H. Boulton, I M.S., to February 19, 1911.

### List of Indian Military Officers on Leave.

*Showing the Name, Regiment, or Department, and the Period for which the Leave was granted.*

Fawcett, Captain F. O'D., I.M.S.

Moorhead, Major A., I.M.S., 1 y., from November 28, 1910,

Munro, Captain D., I.M.S.

### List of Indian Civil Officers on Leave (including Military Officers under Civil Rules.)

*Showing the Name, Province, and Department, and the Period for, and Date from which the Leave was granted.*

Close, Lieutenant-Colonel J. K., I.M.S., U.P., 7 m., November 9, 1910.

Franklin, Captain G. D., I.M.S., India Foreign, 24 m., November 14, 1910.

Leicester, Major J. C. H., I.M.S., B.

Newmarch, Lieutenant-Colonel L. S., I.A., India Polit.

Oxley, Capt. J. C. S., I.M.S., C.P., 20 m. 20 d., October 29, 1910.

Pratt, Lieutenant-Colonel J. J., I.M.S., U.P.

Smith, Major F. A., I.M.S., Beloochistan, 8 m., October 12, 1910.

Stephen, Captain L. P., I.M.S., Bo., 16 m., November 4, 1910.

### Colonial Medical Service.

Dr. Alexander K. Cosgrave has assumed the duties of House Surgeon in the European Hospital at Kuala Lumpur, Federated Malay States, in place of Dr. T. P. Masters.

Dr. H. L. Crane has arrived in England on leave from Trinidad.

Dr. J. W. Eakin is acting as Surgeon-General of Trinidad during the absence on leave of Dr. H. L. Crane, who has arrived in England.

Dr. C. L. Sansom, formerly Medical Officer of Health in the Transvaal, has been transferred to the Federated Malay States as Principal Medical Officer.

Dr. Longfield Smith, of the Imperial Department of Agriculture for the West Indies, has proceeded to St. Croix to investigate the conditions of the office of Head of the Agricultural Department in the Danish West Indies.

### The Society of Tropical Medicine and Hygiene.

At a meeting of the Society held at 11, Chandos Street, Cavendish Square, London, W., on Friday, January 20, 1911, the following candidates were elected Fellows: Captain F. E. Bissell, R.A.M.C., Northern Nigeria; E. Nicolas Darwent, Trinidad; R. F. de Boissière, L.R.C.P., Kadavu, Fiji; Professor José de Magalhães, Lisbon; William J. Dixon, M.B., M.R.C.S., Taiping, F.M.S.; E. Frederic Eliot, F.R.C.S.E., Menaggio; Frederick Hall, L.R.C.P., Mokogai, Fiji; Seale Harris, M.D., Mobile, Alabama; Fred. L. Henderson, M.R.C.S., East African Protectorate; H. N. H. Joynt, M.D., Lautoka, Fiji; W. F. M. Loughman, L.R.C.S., Bareilly, India; O. E. Macguire, M.D., Nakualofa, Tonga; Fitzmaurice Manning, S.M.O., N. Nigeria; Annibal C. Merides, Director Bact. Lab., Angola; Thomas H. Ravenhill, M.B., Antofogasta; Lieutenant-Colonel W. S. Ricketts, I.M.S. (Ret.), Naples; Lieutenant Colonel James R. Roberts, F.R.C.S., Indore; B. van Someren Taylor, M.D., Foochow; John P. Tulloch, M.D., Chaguanas, Trinidad.

### New Year Honours.

*India.*

Lieutenant-Colonel David Semple, M.D., Director Central Research Institute of India, has been granted a Knighthood of the Order of the Indian Empire. The excellent work accomplished at Kasauli in the Punjab by Colonel Semple is well known and he has earned world-wide fame as an investigator and scientist. Colonel Semple was from 1900-1905 Director of the Indian Pasteur Institute. Amongst his many publications those on enteric fever, tetanus and anti-rabic serum are best known. He has already been awarded the Kaisar i-Hind gold medal. We heartily congratulate Colonel Semple on his well-deserved honour.

*Kaisar-i-Hind Gold Medal.*

Lieutenant-Colonel Henry Smith, M.D., and Major Thomas Walter Irvine, M.B., F.R.C.S.E., have been awarded the Kaisar-i-Hind gold medal for eminent work in the Indian Medical Service. We congratulate both on their well-merited decoration.

*South African Union.*

The Right Hon. Leander Starr Jameson, M.D., the most prominent figure in South African public life, whose conciliatory policy made the Union possible has been granted a Baronetcy.

The Hon. J. H. M. Beck, M.D., Senator of the Union of South Africa, has been made a Knight Bachelor.

Of medical men resident in Britain we note: David Ferrier, M.D., F.R.S., has been granted a Knighthood. Dr. Ferrier has been justly regarded as the founder of our present knowledge of cerebral localization, and for a generation has held a foremost position as an authority on mental ailments.

Knighthoods have been bestowed upon:—

Dr. Horatio Bryan Donkin, Medical Adviser to the Persian Commission, and Director of Convict Prisons.

Mr. Frederic Samuel Eve, F.R.C.S., Senior Surgeon to the London Hospital.

Dr. George Newman, Chief Medical Officer of the Board of Education.

Dr. John Michael Redmond, Consulting Physician, Dublin.

## Notices to Correspondents.

**1.—Manuscripts sent in cannot be returned.**

**2.—As our contributors are for the most part resident abroad, proofs will not be submitted to those dwelling outside the United Kingdom, unless specially desired and arranged for.**

**3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.**

**4.—Authors desiring reprints of their communications to the Journal of Tropical Medicine and Hygiene should communicate with the Publishers.**

**5.—Correspondents should look for replies under the heading "Answers to Correspondents."**

## Original Communications.

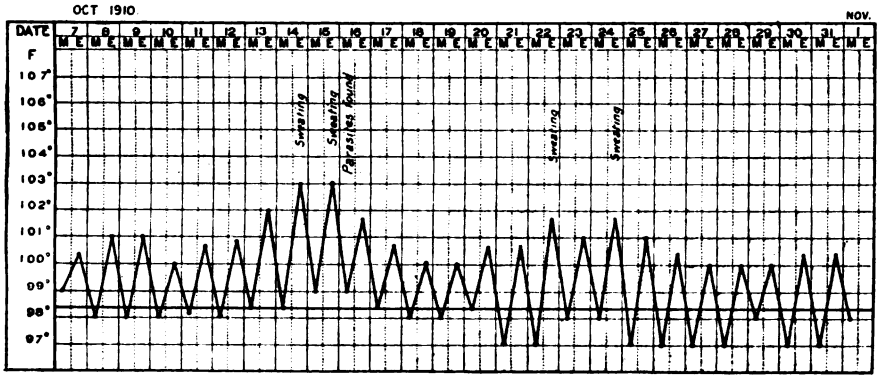
# REPORT ON A CASE OF SLEEPING SICKNESS OCCURRING IN NORTHERN NIGERIA.

By David Alexander.

*Junior Sanitary Officer, Sierra Leone; Late Medical Officer, Northern Nigeria.*

Abba : male, prison warder, Maiduguri, admitted into Hospital October 17, 1910. Left of his own account November 1, 1910.

*History of Case.*—A native of Bautchi town, aged about 30. At about 18 years of age he left Bautchi, and went to Lokoja, by way of Koffi, Abuja, and Koton-Karifi; there he stayed for two months, and then enlisted. Served at Kontogora and Burmi. He left the West African Frontier Force at the end of his six years, having been promoted to the rank of sergeant. Almost immediately he left Lokoja, and proceeded to Loko, where he remained for two months—while there often crossing the Benue to a village opposite, but never going into the country round Loko, a sleeping-sickness area, nor into the neighbourhood of Lafia Beri-beri, also an infected area. He then returned to Bautchi town, remained there seven months, and then came straight to Maiduguri. On arrival here he had an attack of "fever," which lasted ten days, the only symptoms he remembered being fever, pains in the limbs, and headache. As soon as he recovered he enlisted as a policeman, afterwards being taken on as a prison warder on the disbanding of the police in the northern provinces. He has been altogether four years in Maiduguri, and during that time has not at any time been exposed to the bite of a tsetse-fly, having been only out on escort twice, and then to Geidam and Mongonou, where no tsetse exist. During his service in Maiduguri he has only been in hospital twice—once in March, 1910, complaining of fever and very severe pain in the head, when the medical officer being absent, the dresser treated him with quinine. He was discharged at the end of fourteen days, but was admitted again in August, suffering from guinea-worm. He had syphilis before enlisting as a soldier. He admits that it has been an effort of late to do his regular work, and to keep awake while on duty. About a month before admission to hospital, he began to have fever regularly in the evenings, the tendency to fall asleep increased, and he noticed swelling of his feet and ankles. He was not able to say when his skin first became coarse, but he was quite aware of having lost all sexual desire for three months.




Patient was sent to hospital by the Assistant Resident on October 7 with a note to the effect that he was evidently suffering from some disease, as, although of previous good conduct, he had of late got very slack in his work, careless of his appearance, and had often been seen to go asleep on duty. He was admitted to hospital for observation.

*Symptoms.* — In appearance patient is dull and heavy, disinclined to talk, and there is considerable difficulty in making him understand a question and in getting him to answer. It was noticed that this got more marked in the evenings at the time his temperature was higher. The glands in the posterior triangle of the neck were easily palpable like small marbles, firm in consistence; glands were also just palpable in the axillæ and groin. The skin was markedly dry and rough, but no eruption or papules were to be seen. Kerandel's sign of deep hyperæsthesia was present. No tongue tremors except when the temperature was over 100,° and then only slight. No tremors in hands or legs. Slight degree of inco-ordination. Reflexes delayed. No complaint of headache. Difficult to say whether Babinski's sign was present or not. Pupils regular, and react to light and during accommodation. Pulse quick, low tension, average 108, and independent of temperature. Heart normal, no murmurs. Respirations regular and equal, increased towards morning and evening, with rise of temperature. Œdema of feet and ankles. Flabby tongue, anorexia, and constipation. Spleen and liver enlarged.

*Blood Examination.*—From October 9 a fresh blood-film was examined each morning, and two specimens, stained with Leishman, were examined each morning and evening, but it was not until October 16 that trypanosomes were seen. Since that time the fluid from the neck glands has been examined, but with negative results. From the 16th up to the time of his leaving, a fresh blood-film was examined night and morning, with negative results.

Differential Count of W.B.C.

| | | | |
|---|---|---|---|
| Lymphocytes ... ... | 170 ... | 34 | per cent. |
| Large mononuclears ... | 98 ... | 19·6 | ,, |
| Polymorphonuclears ... | 193 ... | 38·6 | ,, |
| Eosinophiles ... ... | 27 ... | 5·4 | ,, |
| Transitional ... ... | 5 ... | 1 | ,, |
| Basophiles ... ... | 7 ... | 1·4 | ,, |
| | 500 | 100·0 | |

Large mononuclears markedly increased.

*Temperature.*—As will be seen from the attached chart, it showed the typical rise in the evening, with morning fall to normal or below. Sweating was only markedly present on the days noted on the chart.

*Remarks.*—The case is of interest on account of the long time which had elapsed from the only possible exposure to infection, *i.e.*, when at Loko four

years previously. The attack of fever that he had on arrival at Maiduguri was possibly the first sign of the disease. It is also remarkable that he was never off duty from illness during his period of service in Maiduguri, with the two exceptions mentioned above. In spite of all I could do or say, he refused to remain any longer in hospital, having been discharged at the end of October as medically unfit. He is at present in the native town, where I hope to keep in touch with him. At first, incontinence of urine and involuntary passage of fæces was periodic, and came on, if at all, during the evening with the rise of temperature, but towards the end of his stay in hospital it became more constant. His gait became a shuffle, and the inco-ordination more marked.

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## SOME NOTES ON BETA-NAPHTHOL AND THYMOL AS ANTHELMINTICS.

By Burton Nicol, F.R.C.S.Eng., D.P.H.Camb.

*Medical Superintendent Indian Immigration Board of Natal.*

During the last two years considerable experience has been gained in Natal in the various methods in vogue for the expulsion of hook-worms, as all Indians are now treated on arrival with anthelmintics before they are sent out to their employers.

Indentured Indian labour has been coming into Natal for some fifty years, but it was not until 1906 that attention was drawn to the fact that these people were hook-worm carriers, and no steps were taken until the end of 1908 to limit the introduction of these parasites. Hook-worm disease is not endemic in Natal, but a limited outbreak in a certain coastal district gave rise to some alarm, and justified the taking of precautionary measures.

In the first instance treatment of the Indians during the voyage to Natal was attempted, but met with very little success. The journey from India is over in the short period of three weeks, and does not give sufficient time for the carrying out of routine treatment. Even with a longer voyage, the exigencies of the regular work of the medical officer and his staff on an emigrant ship do not justify any large addition to their already heavy duties. The weather, the presence or absence of epidemic or other sickness, are all uncertain and frequently unfavourable factors in attempting medication on board ship. The experience gained by ourselves on this point bears out most fully the conclusions arrived at by the meeting held in London in 1908 of Surgeon-Superintendents of Emigrant ships to British Colonies,[1] where this subject was fully discussed. The opinion given was "that no treatment as yet suggested against hook-worms is either efficient or practicable in the circumstances usually prevalent on Indian emigrant ships, and that it is undesirable to adopt as compulsory any routine treatment.

An attempt on an organized scale was next made to carry out purgation of emigrants at the depôts in Madras before embarkation. This met with qualified success, but had finally to be abandoned, owing to the great difficulty of obtaining a sufficient number of Indians willing to submit to treatment. Many of the labourers refused to stay in the depôt, some of them absconding, and others declaring to the Protector their unwillingness to proceed to Natal. Emigrants were restrained from engaging to go to Natal by recruiters for other colonies who depicted in highly-coloured language the terrors of the medication to which the Natal emigrants were subjected. The cost of recruiting mounted up rapidly for various reasons, the chief of which were:—

(*a*) The longer detention of emigrants in Madras.

(*b*) The expense of transporting emigrants over long distances to Madras, who afterwards refused to proceed further on their journey.

(*c*) Owing to the smaller number of labourers obtained, the cost per head was enormously increased.

Altogether the cost of introducing labour from India to Natal was increased per male adult from £10 9s. 6d in 1908 to £24 16s. 11d. in 1909, and the attempt to carry out purgation of emigrants in Madras before embarkation was abandoned.

The emigration agents at Calcutta some time previously had attempted routine purgation of Indians before putting them on board ship. Some rioting ensued, the Indians refusing to submit to further medication and threatening to leave the depôt in a body. The drug given in this case was thymol, and the attempt to continue its use was discontinued at once. In our hands the Tamil labourers in Madras proved to be more manageable, but the difficulties and the expense of carrying on emigration under such circumstances ultimately led to the giving up of all attempts at treatment before shipment of the labourers.

The microscopic examination of the stools for ova, and the observations made by collecting the parasites expelled after the administration of anthelmintics, had convinced us that over 90 per cent. of the Indian labourers were hook-worm carriers. As practically all the emigrants on their arrival harboured the parasite, it was determined to treat all of them without discrimination, and this is now done as a routine measure. Each Indian is now treated at the quarantine station at Durban before he is sent out to his employer.

The method of treatment in use is one that has been gradually evolved as the result of experience. Thymol and beta-naphthol were both used at first, and the results of treatment were tested by microscopic examination of the stools. These examinations were made seven or more days after the administration of the anthelmintic. The results are shown in the following table:—

| Number and sex | Drug | Dose | No. of doses | Result |
|---|---|---|---|---|
| 107 male adults | Thymol | 25 gr. | 3 | 43·8 per cent. negative |
| 197 ,, | ,, | 30 ,, | 3 | 63·0 ,, ,, |
| 42 ,, | B.-naphthol | 25 ,, | 3 | 45·2 ,, ,, |
| 196 ,, | ,, | 30 ,, | 3 | 75·5 ,, ,, |
| 26 women .. | Thymol | 20 ,, | 3 | 69·0 ,, ,, |
| 11 ,, .. | ,, | 25 ,, | 3 | 72·7 ,, ,, |
| 67 ,, .. | B.-naphthol | 25 ,, | 3 | 77·6 ,, ,, |

[1] Proof 23,795, issued by the Secretary of State for the Colonies, July 2, 1908.

It will be seen that beta-naphthol in three doses of 30 gr. each for men and 25 gr. for women gave the best results. The administration of both drugs was carried out in the following way:—

On the preceding evening 4 drachms of sulphate of magnesia or 6 drachms of castor oil were given.

On the following morning we gave at:—

6 a.m., 30 gr. of beta-naphthol (or thymol).

8 a.m., 30 gr. of beta-naphthol (or thymol).

10 a.m., 30 gr. of beta-naphthol (or thymol).

12 o'clock noon, 6 drachms of sulphate of magnesia.

The last meal on the previous day was given at about 4 p m. After this no food was given until two hours after the final dose of sulphate of magnesia. Water or rice water was allowed in moderate quantities during this period. At first the final dose of sulphate of magnesia was 4 drachms (½ oz.), but it was found that some of the Indians had no action of the bowels until the following day, so the quantity of this aperient was increased.

After these results were obtained the use of thymol was discontinued, and beta-naphthol is now used in all cases in doses of 30 gr. for men and 25 gr. for women. Each treatment consists of three of these doses of the drug, given at intervals of two hours, preceded and followed by an aperient. We found it convenient to give the beta-naphthol in the form of a mixture, each fluid drachm of which contains 5 gr. of the drug. The formula is as follows:—

Beta-naphthol, 4 drachms; mucilag. tragac, 1 oz.; aq. menth. pip. to 6 fluid oz.

Of this mixture we give 6 drachms. (30 gr. of beta-naphthol) to a man and 5 drachms (25 gr. of beta-naphthol) to a woman for each dose.

Beta-naphthol in our hands has proved to be a very safe and a very efficient anthelmintic. It has been used now for nearly two years—since December, 1908, all Indian immigrants having been subjected to treatment before they were sent out to their employers. In all some 17,000 to 18,000 treatments have been given to about half this number of Indians, and out of this number only one fatal case of acute nephritis has been observed which could be ascribed to the drug. The case was as follows: A male child, aged 2, was given the usual beta-naphthol mixture, receiving a quantity equal to 5 gr. of the drug. The next day the child had hæmaturia, rapidly developed grave symptoms, and died within forty-eight hours. A *post-mortem* examination was made, all the organs were healthy with the exception of the kidneys, these being congested. The bladder contained some blood-stained urine which was loaded with albumin.

In our hospitals in Natal the drug has been extensively used, and among these cases one fatality has also been recorded. A lad, aged about 12, was out of health, and as he was harbouring hook-worms he was given three 10-gr. doses of beta-naphthol. The next day a most severe condition of general anasarca was present; the urine was greatly reduced in quantity, and on examination was found to be nearly half albumin. A condition of acute nephritis had been set up, and, although every care and attention was given, no improvement was effected and the boy died some three months later. We have thus to record one death in over 17,000 treatments among newly-arrived immigrants, and one death in an unknown but very large number of hospital cases from the use of the drug.

Some observations have been made on the presence or absence of albumin in the urine during the administration of the drug. In a small proportion of the cases thus examined a trace only of albumin was found, and this had disappeared on the following day. It seems probable that in the cases where acute nephritis is set up there is already some chronic inflammation of the kidneys. The Commission for the Suppression of Anæmia in Porto Rico reported in 1905 that beta-naphthol is decidedly inferior to thymol. The reasons for the difference in the results obtained in Porto Rico and in Natal are probably due to the different conditions obtaining in the two countries. The Commission in Porto Rico found that as high a percentage as 83·3 of their cases had albuminuria before treatment was commenced. Beta-naphthol, being admittedly a powerful kidney irritant, was given in doses of from 2 to 3 grm. (30 to 45 gr.) only. Thymol was given in doses of 3 to 4 grm. (45 to 60 gr.), and in these larger doses would be the most effective drug. We make the dose for an adult male 90 gr. in the case of each drug, and in these doses we find that beta-naphthol is more effective as a worm-expeller than thymol. The people to whom we are administering anthelmintics have all been subjected to successive medical examination, and, although they are hook-worm carriers, they are all physically fit and well, and the large majority of them are not seriously inconvenienced by the large doses of anthelmintics administered.

Although the Porto Rico Commission pronounce in favour of thymol, there is some evidence that they looked upon beta-naphthol as the safer of the two drugs under certain circumstances. In their report for 1906-7 they say: "The use of beta-naphthol should be restricted to very few doses, and its administration should be limited to patients in extreme grades of the disease on account of its less depressing action on the vital centres. . . ." The paragraph concludes with a warning against the use of the drug in doses of more than 2 grammes, and this is of much interest now that we have proved it possible to give three times the dose in many thousands of cases with very great safety.

Some very serious drawbacks exist to the use of beta-naphthol. It keeps very badly, and should be used in a fresh condition; it is very variable in quality, some samples having been used which proved to be quite inert. We now only use the drug when guaranteed by the name of a first-class firm of chemical manufacturers, and we take precautions in storing it to prevent the admission of light and air. The pure drug has a crystalline character; it should be well triturated before administration in order that it may be evenly suspended in the mixture in a finely divided condition. In the large doses that we have been giving the drug acts as a powerful depressant of the circulatory system. The extremities become cold, the pulse becomes small and of lower tension, and occasionally the patient complains of syncope. Where these symptoms are exhibited the adminis-

tration of the drug is always discontinued; alcohol is never given owing to the solubility of the drug in this medium, but a little water is administered; and if the patient is left in a recumbent position the unpleasant symptoms quickly disappear. There is no doubt that in the large doses we have been using, beta-naphthol is unsuitable for out-of-door or dispensary practice.

As a general anthelmintic beta-naphthol is very effective; it seems to be almost a specific for thread-worms, these parasites being nearly always present in the stools of our Indians, and sometimes they are seen in very large numbers. Round-worms are frequently expelled, and occasionally tape-worms are seen.

Thymol, when given in full doses, causes very serious disturbance. It acts chiefly upon the nerve centres as an intoxicant and deliriant. It is at first a stimulant—the subject is more inclined than usual to talk and laugh, the face becomes flushed, and the pulse quickens; but very soon symptoms of dizziness are complained of, the subject becoming drowsy and sleepy, the pulse becoming quick and compressible, and sensations of syncope often now appear. In the more serious cases of thymol poisoning the condition of somnolence passes into coma and death may ensue. At our Madras depôt thymol was at first the only drug used. One morning, when a considerable number of Indians were under treatment, two of them became very excited, and ran amok, causing a great deal of alarm. No harm was done, but incidents such as these interfered considerably with the work of medication, and made the other Indians very distrustful of our methods.

In expelling hook-worms we do not regard thymol in equal quantities as being as effective as beta-naphthol, but there is probably very little difference between them in this respect. It is a drug of uniform quality, and one that keeps well almost indefinitely. As a general anthelmintic it is more effective than beta-naphthol; we have found in the stools after its administration thread-worms, round-worms, tape-worms, and flukes. The use of thymol was discontinued by us on account of the very serious constitutional disturbance that it frequently causes. In our hands beta-naphthol has been proved to be more effective, safer, and more easy to administer on account of its absence of taste; it may also be pointed out, as of some practical importance when drugs are being used on a large scale, that it is also incomparably less costly than any other anthelmintic.

In the first few months of our work the routine beta-naphthol treatment was continued in the case of each individual until microscopic examination of the stools proved them to be free from hook-worm ova. If ova were found to be present the individual was subjected to another course of treatment, followed by further microscopic examination, and so on. As time was of value it became important to determine what interval should be allowed to elapse between the treatment and the subsequent microscopic examination. Beta-naphthol is known to inhibit the production of ova by the parasite in the bowel, and observations were now made in order to ascertain how long this inhibition lasted in order that the microscopic examination might not be necessarily delayed.

For the purpose of these observations thirty men were placed under the usual treatment—*i.e.*, three 30-grain doses of beta-naphthol, preceded and followed by an aperient. In each instance specimens of the stools were examined on the first, second, third, fifth, seventh, tenth, and fourteenth days; four smears ($\frac{7}{8}$ in. cover-slips) were examined from each case on these days, and the total number of ova seen were counted and recorded. In nineteen of the cases no ova were found. In the remaining cases the number of ova found in the specimens was very small up to the fifth day; they were more numerous on the seventh day, more numerous still on the tenth day; the numbers dropping considerably again on the fourteenth day of the examination:—

NUMBER OF OVA FOUND ON THE

| | 1st day | 2nd day | 3rd day | 5th day | 7th day | 10th day | 14th day |
|---|---|---|---|---|---|---|---|
| 19 cases | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Case 5 | 0 | 0 | 0 | 1 | 0 | 1 | 3 |
| ,, 16 | 0 | 0 | 1 | 0 | 0 | 0 | 2 |
| ,, 17 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| ,, 19 | 0 | 0 | 0 | 0 | 2 | 5 | 3 |
| ,, 21 | 0 | 0 | 0 | 0 | 6 | 3 | 0 |
| ,, 23 | 8 | 0 | 0 | 0 | 5 | 4 | 3 |
| ,, 24 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| ,, 25 | 0 | 0 | 0 | 5 | 3 | 4 | 5 |
| ,, 27 | 6 | 0 | 0 | 0 | 5 | 10 | 3 |
| ,, 28 | 0 | 0 | 0 | 0 | 3 | 4 | 2 |
| ,, 30 | 2 | 0 | 0 | 1 | 4 | 6 | 4 |
| Totals | 18 | 0 | 1 | 7 | 28 | 37 | 25 |

Several of the cases illustrate the difficulty of finding ova where the remaining parasites are probably few in number; a case may be positive on one day and negative on another, although the same time and care are expended over each examination. The number of ova found on the first day, and their absence on the second day after treatment, suggests the presence of ova in the fæces which belonged to parasites already expelled. In two of the cases ova were found on the first day, but not on any subsequent occasion. The resulting totals show that a fair number of ova were found on the first day after treatment, but that very few ova were again found until the seventh and subsequent days were reached; in other words, the inhibition of ova production that is produced by the drug lasts for about seven days, and if the effect of the drug is to be gauged by microscopic examination of the fæces, this examination must be delayed for a period of at least seven days after treatment has been carried out.

NEW DIPLOMA IN TROPICAL MEDICINE.—A report was received from the Committee of Management submitting regulations for the new Diploma in Tropical Medicine, which is to be granted by the Royal Colleges of Physicians and Surgeons. The examination for the Diploma is to be conducted under the superintendence of the Conjoint Board. The regulations were approved and adopted.

The Council of the Royal Society of Medicine has presented to the College the Osteological Collection formerly belonging to the Obstetrical Society.

## Business Notices.

1.—The address of the JOURNAL OF TROPICAL MEDICINE AND HYGIENE is Messrs. BALE, SONS AND DANIELSSON, Ltd., 83-91, Great Titchfield Street, London, W.

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Contributors of Original Articles will be supplied FREE with six copies of the Journal if a request accompany the MS. If reprints are required they will be supplied by the publishers, **if the order is given** with remittance **when sending the MS.** The price will be as follows:—

50 Copies of four pages, 5/-;
100 ,, ,, 6/-;
200 ,, ,, 7/6;
50 Copies beyond four up to eight pages, 8/6;
100 ,, ,, ,, 11/-;
200 ,, ,, ,, 14/6.

One page of the Journal equals 3 pp. of the reprint.

If a printed cover is desired the extra cost will be, for 50 Copies, 5/6; 100 Copies, 6/6; 200 Copies, 7/6.

THE JOURNAL OF

# Tropical Medicine and Hygiene

FEBRUARY 15, 1911.


## PLAGUE IN MANCHURIA AND ITS LESSONS.

THE epidemic of plague in Northern China has aroused interest throughout the world in a measure unknown since 1894 and 1896, when the disease appeared in Southern China and in India. The fatal nature of the malady has also served to add to the interest and has created something of the nature of a scare in countries far remote from the seat of the outbreak. In great Britain, owing to the threat of plague in the county of Suffolk, the epidemic in China has tended to draw special attention to plague in its various phases.

Two excellent articles in the *Times* (January 30 and February 4, 1911), by Dr. Sambon, served to throw fresh light upon the epidemiology of plague and to draw attention to the manner of its spread For some ten years and more scientific observers have been devoting their investigations to the question of how rats and their fleas infect man. This form of communicability is now practically settled, but it may be that whilst focussing attention upon the rat fleas we have neglected to study the epidemiology of plague in a wider and yet a more alarming aspect. The pneumonic variety of plague prevailing in North China is admittedly communicable directly from man to man; but it is customary to regard the bubonic variety as being conveyed only by the fleas of rats and other animals subject to the disease. The latter is a more or less comforting assumption, but the question of the truth of the belief is one which cannot be said to have been established. Bubonic plague at the commencement of an epidemic in any district is practically as fatal as the pneumonic form. In Hong Kong in 1894, when the outbreak first occurred, not a single case of bubonic plague under the care of the writer recovered, and in these early days if a patient suffering from the disease was reported to have recovered, doubt arose in our minds as to the correctness of the diagnosis in the first instance. During recurrences of the disease in subsequent years, however, the mortality lessened and recoveries were not unheard of. It is possible that the same may be the history of pneumonic cases of plague, for although the pneumonic variety has been reported as occurring again and again in all places where bubonic plague has prevailed, it is the first time in recent years where the pneumonic type has ushered in the disease in a severe form and existed as an epidemic to almost the exclusion of the bubonic variety.

In attempting to gauge the epidemiology of plague it may be well to deal with the matter from a historic point of view. In 1893—that is the year before plague became epidemic in South China—a large number of cases of "buboes," in the groin especially, prevailed throughout the far East from Singapore to Hong Kong, and possibly elsewhere. The writer brought up the matter for discussion at the British Medical Association Branch in Hong Kong, and several letters were received about the same time from medical men in Singapore and from French doctors in Saigon, asking if in Hong Kong we had experience of these "buboes," as they had seen so large a number that it might be termed an epidemic. Then during this time two (or more) curious cases occurred.

(1) A Japanese girl with unusual symptoms died in 1893, and Dr. Atkinson, now the Principal Medical Officer in Hong Kong, whose patient the girl was, reported the case at a medical meeting and said that he had searched the literature in order to try to explain the nature of the disease of which the patient died, but that he found nothing he could read of which corresponded to the clinical and pathological findings of this case except plague. The astonishment created by this statement, in pre-plague days, may be well imagined, but there was no doubt Dr. Atkinson was right, so that he was the first to diagnose the group of signs and symptoms we are now so familiar with as plague. The symptoms of the Japanese girl were peculiar, for she was originally under the care of Dr. Hartigan and the writer, and after a month of treatment with her ailment undiagnosed left for her home. Shortly afterwards she died in the hospital under Dr. Atkinson's observation. Viewed now with the full knowledge of plague one possesses this patient's symptoms were peculiar in their chronicity. The glands in almost every part of the body, including the abdomen, were enlarged, and there was fever, subcutaneous hæmorrhages, &c., &c.; these in a few weeks subsided, but a recurrence took place

with fatal results. This occurred in the midst of the outbreak of the buboes above referred to.

(2) Shortly after this a young Englishman in Hong Kong was laid up over a month with an ailment which was also undiagnosed by Dr. Hartigan and myself. He had fever and enlarged glands in almost every part of his body; those in the abdomen where they amounted to several dozens could be readily palpated. He recovered after five weeks' illness.

There is no doubt these were cases of plague—"preliminary cases" so to speak, exaggerated form of the "groin bubo" cases we had become familiar with.

The "groin-bubo epidemic" mostly occurred amongst engineers and sailors in the merchant service, and it was only after some experience that they were allowed to be of a non-venereal character. Several "groin-bubo" cases were subsequently described by surgeons in the British Navy serving on the China Station and baptized "climatic bubo," a new name for an apparently new disease, which appeared just before plague declared itself and continued during its prevalence. It is also a striking fact that climatic buboes have only occurred amongst those who have been in contact with plague-stricken ports and countries. A surgeon in the British Navy described cases of "climatic buboes" amongst sailors on the Zanzibar coast, about the same time as Koch described a plague centre in the Zanzibar Hinterland. The writer had a case of climatic bubo in London in a doctor just home from the Mysore goldfields where he was on plague duty for a considerable time. This case was reported by Professor Hewlett and the writer. Professor Hewlett found in the discharges a bacillus resembling a plague bacillus but *not conforming with all the tests necessary to stamp the disease* as one due to the presence of the typical plague bacillus. The *non*-conformity is, perhaps, the most interesting point of all from what we now know of plague. It is possible that we are dealing with varieties of plague bacilli which bear distinct relation to the type of the disease which prevails at any given time or place. That "climatic buboes" are neither more nor less than plague due to a special variety of the bacillus (usually termed a pseudo-bacillus) which is met with in pronounced types of the disease there can be no doubt, and the writer has styled the condition pestis minor. It will be seen that by this is not meant a mild clinical variety of virulent bubonic plague, but a disease due to a special strain of the plague bacillus which runs a definite course and only gives rise to its like (for a time) in other people. That pestis minor runs also concurrently with true plague was well illustrated during the outbreak on the Volga in 1877. At Astrakhan true plague prevailed and many deaths occurred, but in a town 150 miles higher up the Volga the people suffered from an outbreak of buboes which amounted to an epidemic, but no deaths resulted; they, in fact, had the specific type of mild infection—pestis minor.

The writer would classify the possible stages of plague infection of a country as those of:—

(1) Pestis minor.
(2) Bubonic plague.
(3) Pneumonic plague.

That these are related the one to the other would seem uncontestable; that each possesses a special variety or type of virulence due to peculiar characters of its bacillus, and transmitted in different ways in each type, would also seem true. The rat-flea infection plays, no doubt, a part in this scheme, but, as Dr. Hossack, of Calcutta, remarks, it is but a link in a chain of some length, a chain, we would add, in which other animals and man play a part.

To sketch the sequence of events in plague epidemiology with scientific accuracy is at present impossible, but that there are stages in virulence due to variety in the type of bacillus and in the mode of transmission would seem more than probable.

To begin with, animals, and chiefly rodents, would appear to be primarily infected. Amongst these animals plague may prevail for years before an outbreak occurs in man. To take one instance: We know that the tarbagan (*Arctomys bobac*) in Mongolia, a species of marmot (rodent) has been infected with plague for over twelve years. (Clemow, *Journal Tropical Medicine*, February, 1900.) Plague has occurred in sporadic form from time to time in the district, and in 1894 a severe visitation of the disease occurred there. As far back, however, as 1888, plague existed in Mongolia, and from then until the present time recurrences have been reported.

It may be interesting and instructive to refer to the history of the plague in Mongolia, in connection with the Manchurian outbreak, with which it is no doubt directly connected.

In the district of Aksha, in the Transbaikal Province of Siberia, plague has been known to exist since 1888. Aksha is in longitude 115° East, and latitude 50° North, and the principal centre of plague is round Tzagan-olui, a place close on the Russo-Mongolian frontier. The disease is known in that district as *tchuma*, the Russian term for plague. Here the tarbagan (*A. bobac*) is regarded as the cause of the disease in man. The tarbagan is much sought after by the Cossacks and Buriats, who inhabit the district for the sake of the fat which accumulates chiefly in the abdomen towards the autumn, and just before the animal retires into its hibernating quarters in September.

The tarbagan is in some years attacked by an epizoötic with the following symptoms: The animal becomes languid and ceases to bark; its gait is unsteady and under one shoulder there sometimes appears a reddish, tense swelling; if far from its hole the animal fails to find it, and if it reaches its hole the other healthy animals refuse it admittance, when it falls a prey to wolves, who have a great liking for marmot, whether healthy or diseased. The wolves do not contract the disease from eating the marmot, and this scavenging by the wolves is considered the chief reason why men escape so frequently from the disease as they do. Should, however, people handle a marmot dead of the disease, sickness is almost sure to follow and death, as a rule, occurs in a few days. This disease, which is endemic in the district referred to, is now recognized locally as identical with plague, but its spread is confined to the family of the person first attacked. It would seem probable that the fleas of this animal communicate the disease to the members of the household and that only those bitten by them are attacked by the disease.

A different state of affairs, however, exists in a district in Eastern Mongolia, some 480 miles further south. In this district plague was known to exist in 1888 and every year since it has recurred regularly, now mild, now more severe. Although tarbagan are numerous in the district, no observers nor the people themselves attribute the disease to infection from marmots, rats, or domestic animals, as none of these have been found diseased. These observations are interesting, and the behaviour of the disease in the two localities is equally so. In the Siberian centre the disease is occasional, coming only when the marmot is affected and seldom spreading beyond the house where a diseased marmot has been handled. In Mongolia the animals are not known to be infected, the disease occurs annually in the summer, and it spreads in an epidemic form amongst the people over a considerable area. Here we have two forms of spread, one occasional and attacking members of one household, the other regularly recurring, and affecting the neighbourhood in an epidemic form. The former is from infected animals, the latter from infected people. In the Mongolian outbreaks pneumonic forms occur in about one third of the persons attacked. It is interesting to note that in the Mongolian centre a number of Manchurians have settled, and between the two places, no doubt, people pass backwards and forwards from time to time, and since the railway opened intercommunication has become more free. The disease which appeared in Manchuria in 1910 is more of the nature of that which prevails in the Mongolian centre, but the pneumonic form prevails. Here we would seem to have interesting material for consideration. One centre (Siberia), where the disease reaches man from an animal, the marmot, and appears in endemic form; a second centre (Mongolia), where the disease is partly bubonic and partly pneumonic; a third centre (Manchuria), where the pneumonic type prevails. This would serve to support the belief that the plague bacillus passes through stages of development in type: first, the variety that is brought about by the bite of fleas of an animal suffering from the disease, but not going further; second, the type which becomes epidemic by passing from man to man probably by fleas carrying infection from one individual to another; third, the type that passes from man to man without the intervention of a carrier or by insects as well.

The lesson to be learned from this is that there are three stages in this disease. Pestis minor, carried only by insects from diseased animals, always local—a household outbreak in fact—in which a pseudo-plague bacillus is found in man. Bubonic plague, carried from man to man by insects. Pneumonic plague passing from man to man without the intervention of insects. The virulence of each variety gathers in intensity. Time is required for one type to change to another more virulent, each variety propagates its like until by prolonged cultivation in the blood and tissues of a particular animal, or in man, it changes its type and becomes specific for that animal. As the tuberculosis of animals may in time, and in suitable soil, change in type so that it develops in man and then is directly transmitted from man to man, so is plague in time altered in type so that it no longer requires an animal host, but in times of epidemic passes from man to man, and becomes wholly a disease of human beings.

The stages would appear thus to be:—

(1) Disease in animals.

(2) Pestis minor conveyed by infected insects.

(3) Bubonic plague, sporadic cases, carried from animals to man by insects.

(4) Epidemic bubonic plague carried from man to man by insects.

(5) Pneumonic plague passing from man to man directly, or conveyed by insects.

It would seem, therefore, that severe as bubonic plague has been in China and India, yet a worse form may develop, for pneumonic plague is the culmination of this chain of virulence, and China and India may have been but the fostering beds in the development of the bacillus which has now attained its highest development in Manchuria, and may pass over the world, as it has frequently done before, in the form of the Black Death. At present, science offers no means of preventing such a calamity, except it be a preventative such as Haffkine's prophylactic serum, which would seem to have done good service in India, where bubonic plague has chiefly prevailed.

That some such scheme of development appears probable all evidence indicates. We had first in the Indo-China and Chinese coast climatic buboes, or pestis minor, then bubonic plague in South China, which, transmitted to India, continued its type there; then during the continuance of bubonic plague in China and India, the appearance of at first a few and then a number of cases of pneumonic type; and finally the appearance and continuance of a primary pneumonic plague in North China.

Infection by rat fleas is sufficient to explain sporadic cases of bubonic plague, and plague endemicity, but it is wholly inadequate to explain an epidemic of bubonic plague which can only occur by infection from man to man, possibly by insect carriers.

An important point to be observed in the epidemiology of plague is that animals, chiefly rodents, the rat in many places, the marmot in North China, the squirrel in the United States, &c., may suffer from plague for years without infecting mankind, except in a sporadic way. Then suddenly, an outbreak occurs which prevails in an epidemic form. In Northern China this has been proved to be the case, and in any country where rodents are infected the same sequence may be anticipated. Rats have in Britain been found to be infected—in Glasgow, in the Port of London, and in Suffolk; in Germany, in Hamburg and elsewhere; squirrels are known to be infected in the United States, more especially on the Pacific slope. In these countries small outbreaks of a sporadic nature have occurred from time to time. The outlook, reasoning from experience, is not hopeful, for the peoples of these countries are dwelling in places in which rodents are infected, and at any moment the disease may appear in an epidemic form in man.

J. CANTLIE.

# Reports.

## LIVERPOOL SCHOOL OF TROPICAL MEDICINE.

An interesting function took place at the Adelphi Hotel, Liverpool, on Thursday, January 19, when Mr. Lever, the Chairman of the School, entertained a large gathering of gentlemen connected with the School or having business relations with the Tropics.

The immediate object of the dinner was to bid farewell to Professor J. L. Todd, a former scientific worker at the School, and a member of previous expeditions, and now of the University of Toronto; to Dr. Wolbach, of Harvard University; and to Mr. E. D. Todd, who is to accompany the expedition as hunter and naturalist. Those who have followed the subject of trypanosomiasis will recall that Dr. Todd, one of the first workers on this subject, called attention to the enlargement of the post-cervical glands, in which the trypanosomes could be demonstrated by puncture, as an early sign of infection, and maintained that it was pathognomonic, allowed of a method of early diagnosis, and consequently of early preventive treatment which is simple and easy of application. Observers in Central Africa, on the other hand, have not found that this is an invariable early feature, and Dr. Todd is proceeding to Senegal and the Gambia with the view of eliciting additional facts in support of his contention, and of studying generally the subject of sleeping sickness.

Mr. Lever was supported by Sir Owen Phillips, K.C.M.G., Mr. F. C. Danson, Mr. Harrison Williams (Vice-Presidents of the School), Professor Ronald Ross, Sir Rubert Boyce (Dean), Professor Newstead, Dr. Prout, C.M.G., and other members of the teaching staff, Sir Wm. Bowring, Bart., Sir Edward Russell, &c.

Mr. Lever paid a touching tribute to the founder of the School, Sir Alfred Jones, and proposed, "Our Founder of revered memory," which was drunk in silence, the glasses afterwards being reversed.

He then submitted the toast of the evening, "The Twenty-Seventh Expedition of the Liverpool School of Tropical Medicine."

After mentioning the various expeditions in which Dr. Todd had taken part, he said that they had every reason to be proud of the work done by the Liverpool School, and although there had been much encouragement in the results which had been attained, he thought that the Government had not done its share, and he considered that he was justified in calling upon them for greater efforts and the expenditure of larger sums of money in combating these fatal diseases of the Tropics which were to a large degree preventable. He instanced Panama, a locality which formerly was notoriously the most unhealthy spot on the face of the earth, as an instance of what could be done by the scientific application of modern application in tropical medicine. The death-rate had now been reduced to less than it was in Liverpool, and what had been done there could equally be done in the British Colonies by the expenditure of sufficient sums of money.

As a business man he pointed out that it would be an investment which would return, not a paltry 5 or 10 per cent., but at the rate of thousands per cent. There was not only a constant loss in the shape of human lives, there was the loss to the widows and orphans who were left, and the cost of their maintenance; there was a loss in mental efficiency, the removal of which would be reflected in the business returns; and there was a loss of produce which would reach this country were it not for the drain in health which prevented its collection. He called on the Government to insist on greater local effort.

After briefly referring to the necessity of properly educating the native in sanitation and other useful subjects, instead of such matters as the reigns of the Plantagenet kings, he concluded by proposing success to the expedition and the safe return of the various members.

Professor Todd, in reply, said that civilization had gradually worked eastward, but could now get no further, and the tendency was now to expand southward, and to do this it was necessary to make the Tropics healthy. He appealed to the Press to stimulate public opinion and keep interest alive in this great work.

Dr. Wolbach paid a tribute from Harvard University to the work done by the Liverpool School, with which he was proud to be associated. He hoped they would be able to verify or to disprove the theory which they held as to the early stages of sleeping sickness.

Sir Edward Russell proposed "Commerce and Medical Science." One result of tropical medicine had been to revolutionize medical science, and the commerce of Liverpool was proud to be associated with it. The association of commerce and tropical medicine had been the means of increasing the happiness and amelioration of the conditions of those who had to live in the Tropics, both native and otherwise.

Sir Owen Phillips, Sir Rubert Boyce, and Professor Ross also spoke to the toast.

A warm vote of thanks to the Chairman closed the proceedings.

## THE PREVENTION OF MALARIA IN THE FEDERATED MALAY STATES.[1]

The report contains the results of Dr. Malcolm Watson's anti-malarial work carried out in recent years in Klang, Port Swettenham, and in the rural districts of the Federated Malay States. As this individual campaign has now been in progress for ten years or more, the results must necessarily be of the greatest value for comparison with those obtained elsewhere, and also as showing what can be done by intelligent co-operation and labour in an intensely

[1] "The Prevention of Malaria in the Federated Malay States," by Malcolm Watson, M.D.Glas., D.P.H.Camb., Chief Medical Officer, Estate Hospitals Association, Klang, F.M.S.; late Senior District Surgeon, F.M.S. Medical Service. With a preface by Ronald Ross, C.B., F.R.C.S., D.P.H., M.D., LL.D., D.Sc., F.R.S., Professor of Tropical Medicine, University of Liverpool. Published by the Liverpool School of Tropical Medicine. Price 7s. 6d. 1911.

malarial zone. The conclusions Dr. Watson draws from his Malayan observations are as follows: (1) That both flat and hill land in Malaya before opening are very malarious, and blackwater fever has been found on both. (2) That hundreds of square miles of the flat land of Malaya have been freed from malaria by simply draining and felling the jungle. (3) That the cost of these rural anti-malaria measures in Malaya (where labour is dear) is about £3 sterling an acre, being £2 to drain and £1 to fell the heavy virgin jungle. This expenditure at the same time is the first step in agriculture, and the land has then acquired a considerably increased value. (4) That this freedom from malaria coincides with the disappearance of an anopheline which breeds in undrained jungle, and does not breed in open earth drains when the latter are kept clear of weeds, and flowing. (5) That certain hilly land, intersected by ravines, although opened and drained, is as malarious as when first opened. (6) That the continuance of malaria in the hilly land is due to an anopheline (*Nyssorhynchus willmori*) which, breeding in ravine streams, cannot be driven from them despite the utmost care in keeping these streams free from weeds, and cannot be completely washed out of the ravines, even by the heaviest tropical showers. (7) That quinine given regularly greatly reduces the sick- and death-rate of those exposed to malaria. (8) That doses of less than 6 gr. daily are of little value if the malaria be intense—say where the spleen rate is 75 or more. (9) That when given in 10-gr. doses on six days out of the seven, and in 20-gr. doses when a coolie has pyrexia or is in such health that he does not feel inclined to work, between 20 and 30 per cent. of these taking the drug will be found with parasites in their peripheral blood, where the malaria is intense, and the population consists of immigrants. (10) That the use of quinine can therefore never result in the abolition of malaria, or even make any material reduction in the liability to infection in a malarious locality. (11) That mosquito-proof houses have a value, but the attempt to discover a satisfactory mosquito-proof coolie line ended as an inconclusive experiment. (12) That not only for urban, but for rural districts anti-malarial sanitation should be based on mosquito reduction if this be a physical possibility.

Since these conclusions were written Dr. Watson has carried out further experiments for attacking the *N. willmori*, the anopheline that breeds in the ravine streams of hilly lands, even though the water in these is clean and free from weeds. Under-draining for surface collections of water and small streams is recommended for the purpose of effectually drying up their breeding places.

No attempt, Dr. Watson says, need be made to carry storm water under ground. That will flow as as usual down the earth drains. What is necessary is to ensure that once in eight or ten days the bottom of the earth drain will be quite dry. This should ensure the destruction of any larvæ which may be breeding in them. This new underground method of drainage, it is to be hoped, will be successful where other means have failed, but it will not, of course, probably be suitable for all places. The importance of the thorough study of malaria cannot, Dr. Watson thinks, be over-estimated. The labour problem in Malaya at the present moment is of the supremest importance and the question will become more acute every year. Still, with our present knowledge of malaria, he believes that there will be no difficulty in eradicating the disease, even on the most unhealthy estates, and with its disappearance the labour problem will become one of little difficulty.

## Drugs and Appliances.

"TIODINE," the only organic iodine compound that can be given by hypodermic injection, possesses intact the properties of thiosinamine. The preparation is indicated in all the states and conditions in which iodine, the iodides, and thiosinamine are indicated. Tiodine is issued by A. Cognet, 43, Rue de Saintonge, Paris.

"HEMONEUROL" (Cognet) is a granulated compound in which oxyhemoglobine, kola, and calcium glycerophosphate are blended. Useful in asthenia of all kinds.

"GLAXO" is a preparation made by the "Glaxo" Company, St. John's House, Minories, London, E.C., from milk, to which cream and lactose are added before the process of desiccation is commenced. To prepare "Glaxo" for use, boiling water is added to the flaky powder, when a germ-free milk results. "Glaxo" possesses the further advantages that it is readily portable, that it keeps in any climate and for almost any length of time if the powder is kept in air-tight bottles.

ALBULACTIN, a soluble milk albumin prepared by A. Wulfing and Company, 12, Chenies Street, London, W.C., gives to cow's milk the same percentage of milk-albumin met with in human milk, and renders the milk readily digestible.

STYPTOL, a neutral cotarnine phthalate, is a uterine hæmostatic and sedative of value. Messrs. Knoll and Company, 8, Harp Lane, London, E.C., issue styptol in tablets and powders. In all inflammatory and congestive conditions of the uterus, in pure climacteric hæmorrhage, in hæmorrhage due to myoma, in cases of inoperable cancer, and in hæmorrhage from the urinary tract, styptol has given good results.

BROMURAL, a powerful nerve sedative and mild hypnotic, is of use in cardiac neuroses, in chorea, pruritus, in whooping-cough, hysteria, and in all disturbances of the sensory area. Messrs. Knoll and Company have prepared bromural in tablets and in powder form.

ADRENALIN "GAUZE-TAPE" is prepared by Parke, Davis and Company, 50, Beak Street, Regent Street, London, W., and sent out in two lengths and widths, namely, 10 yd. of ½-in. width, or 5 yd. of 1½-in. width. The gauze is impregnated with adrenalin chloride solution, 1 in 2,000, and is especially useful for packing the nose, tooth-sockets, wounds of the

skin, and as a tampon during any abdominal operation.

DIRECTIONS FOR USE OF CYLLIN.—Mr. J. T. Ainslie Walker has written a useful pamphlet indicating the uses of cyllin as prepared by the Jeyes' Sanitary Compounds Company.

In consequence of the presence of lime in varying proportions in ordinary tap water, clean soft water should be used for dilution. Where it is desired to use water containing lime salts in appreciable quantities, a preliminary treatment of the water with 1 or 2 per cent. of cyllin liquid soap is recommended.

Where the only water available is very hard, salt, or brackish, crude cyllin should be used.

| | Mix with water |
|---|---|
| *For General Hygienic Purposes—* | |
| Cesspools, sinks, lavatories and urinals | 2 teaspoonfuls to 1 quart |
| Shops, factories, schools | 1 tablespoonful to 1 gall. |
| Beer and wine cellars | ,, ,, ,, |
| Stagnant pools and ditches | 2 tablespoonfuls to 1 gall. |
| Spittoons | 1 teaspoonful to 1 pint. |
| *For Infectious Diseases—* | |
| Night commodes | 1 teaspoonful to 1 pint. |
| Utensils and floors | 1 teaspoonful to 1 quart. |
| Spray for walls, &c. | ,, ,, ,, |
| Bath for soiled sheets | 1 tablespoonful to 1 gall. |
| For the skin | 1 teaspoonful to 2 quarts. |
| *For Stables and Kennels—* | |
| Wash or spray for floors, walls, mangers, &c. | 1 tablespoonful to 1 gall. |
| Horses and dogs—Wash | ,, ,, ,, |
| Wounds and sores | 1 teaspoonful to 1 quart. |
| Mange, eczema, quitter, cracked heels, &c. | 1 tablespoonful to 1 gall. |
| Insects on horses and dogs | ,, ,, ,, |

"SERUM THERAPY, WITH NOTES ON VACCINES AND TUBERCULINS," is an instructive pamphlet published by the Wellcome Physiological Research Laboratories. After a review of the earlier work on preventive inoculation, of the meaning of natural and acquired immunity, the preparation and uses of sera are dealt with. An exact description of how diphtheria antitoxic serum is obtained is given as an illustration. The whole of the known serum preparations are then considered and the vaccines of every kind described. The uses of tuberculin, the demonstration of the opsonic index, Ehrlich's theory of immunity, and the Bordet-Gengou reaction are fairly fully set forth. The pamphlet, which extends to 129 pp., is clearly written, readily understandable, and conveys in simple language the intricate subjects dealt with. A careful perusal will well repay the reader.

"SANERIN," a pure, active culture of vigorous strains of lactic acid bacteria, containing the true Bulgarian bacillus, is prepared by Messrs. Allen and Hanbury, 37, Lombard Street, London, E.C., in the form of tablets and as a liquid culture. Clinical experience has shown the value of sanerin in diarrhœa, enterocolitis, in the treatment of ear, nose, throat ailments, in chronic gleet, in rheumatoid arthritis, in gout, and intestinal intoxications generally.

E. LEITZ, the well-known manufacturers of microscopes, microtomes, photographic lenses, &c., have recently published new editions of their catalogues of Photo-micrographic and Projection apparatus. Their general catalogue has now been divided into nine sections as follows: (1) Catalogue of Microscopes, No. 43A. (2) Catalogue of Petrological and Metallographic Microscopes, No. 43B. (3) Catalogue of Dissecting Microscopes, Lens Holders, and Magnifiers, No. 43C. (4) Catalogue of Microscope Accessories, No. 43D. (5) List of Hæmatological Appliances, No. 43E. (6) Catalogue of Microtomes, No. 43F. (7) Catalogue of Photo-micrographic Apparatus, No. 43G. (8) List of Projection Apparatus and Drawing Appliances Involving the Principle of Projection, No. 43H. (9) List of Prism Binoculars, No 43J. Electros of the illustrations contained in these catalogues are at the service of authors wishing to describe, or refer to, any of Leitz's instruments in their works or papers. These catalogues are well worth having a look at, and a run through them will amply repay anyone for the trouble taken.

MESSRS. EVANS, SONS, LESCHER AND WEBB, of Liverpool, in their Analytical Notes for 1910, state:—

*Papain.*—That papain, unlike pepsin, is more active in faintly alkaline media. This is contrary to certain published results, and may explain the unsatisfactory results of this meat-digesting substance, as papain is usually given at the time the contents of the stomach are actively acid.

*Quinine Bisulphate.*—A sample was examined which had undergone very rigorous climatic effects in the Tropics; the colour had become a very pronounced greyish shade. The sample was apparently of quite normal purity and contained 59·2 per cent. of alkaloid.

*Borobenphene-Heil* has the antiseptic properties of boracic acid, benzoic acid sublimed from Siamese gum benzoin, phenol and glycerine.

*Glycobenphene-Heil* has virtually the same properties as Borobenphene-Heil, the proportions of the constituents being somewhat changed, and it contains pure oxide of zinc.

Borobenphene-Heil is used for the treatment of affections of the ear, nose, throat, and mucous membranes of the human body, wherever an antiseptic is indicated, and is of great benefit in the treatment of bronchitis by inhalation or by means of an atomizer.

Glycobenphene-Heil is used for eczema and kindred skin diseases. Both preparations are issued by H. Heil Chemical Company, St. Louis, U.S.A.

## Reviews.

TRAITÉ PRATIQUE DE PATHOLOGIE EXOTIQUE, CLINIQUE ET THÉRAPEUTIQUE. Publié en fascicules sous la direction de MM. Ch. Grall, Médecin Inspecteur-Général du Service de Santé des Troupes Coloniales; et A. Clarac, Médecin Principal des Troupes Coloniales, Directeur de l'École d'Application du Service de Santé des Troupes Coloniales. II. Parapaludisme et fièvres des Pays Chauds. Par Paul Gouzien, Hébrard, Ch. Grall, Camail, Thiroux, Mathis, Leger, Gaide, Lebœuf, Thibault. Avec 26 figures. Paris: J. B. Baillière et Fils, 1911.

The above work forms the second fasciculus of a contemplated series of eight numbers on subjects

connected with exotic pathology, the French name for tropical medicine.

The first fasciculus, already published, deals with paludisme malaria — the second (the one under discussion) deals with parapaludisme and fevers of hot climates; while future numbers will contain the following: Fasc. III. Yellow fever, plague and cholera. Fasc IV. Exotic maladies of the digestive apparatus. Fasc. V. Exotic parasitic maladies. Fasc. VI. Exotic maladies of the skin. Fasc. VII. Intoxications and general maladies of the colonies. Fasc. VIII. General maladies and surgical affections of the colonies.

Under the heading of Parapaludism are included blackwater fever (fièvre bilieuse hémoglobinurique) and nervous troubles of paludism and parapaludism, including malarial neuritis; then climatic fevers are dealt with, then sunstroke, then tick fever, then the recurrent fever of Indo-China, then kala-azar, including infantile kala-azar, and finally Malta fever.

The material included within the book thus covers a considerable amount of ground.

The articles are well written, evidently by men who have had considerable experience of the subjects they deal with, and, such being the case, form very instructive reading. What part, if any, malaria really bears to the production of the vast number of symptoms described under "the nervous troubles of paludism and parapaludism" is not quite clear. Some authorities are even dubious as to there being such a disease as malarial neuritis, but Dr. Grall goes much further than this, describing such conditions as "local asphyxia of the extremities," "burning of the feet," "symmetrical gangrene," "analgesic ulcer," nervous colics, and palustral paralyses, as all being predisposed to, or actually caused by, malaria.

He rather labours his point in trying to prove the part paludism plays in the production of these, in his differential diagnosis chapter, and there is little doubt that if alcohol, syphilis, beri-beri, and other forms of neuritis are carefully put out of court, little if any room is left for malarial cases. While not absolutely denying that such a disease as malarial neuritis may exist, it is certainly extremely rare, and the discussion of it and the other nervous troubles of paludism hardly require the fifty-odd pages of valuable space given to them in the book. Some of the climatic fevers are specially interesting, but here, again, when these are carefully studied, many of them will resolve themselves into anomalous forms of ordinary well-known diseases.

The climatic fever of the Antilles is probably—though this is not absolutely certain—larval yellow fever, and some of the others may be forms of dengue. The articles on the recurrent fever of Indo-China, kala-azar, and Malta fever are good, and a very fair and accurate picture is given of these maladies. The volume is well worth reading. As there are so many works on tropical medicine now, however, it would hardly repay a translation into English.

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PRACTICAL BACTERIOLOGY, BLOOD WORK AND ANIMAL PARASITOLOGY, INCLUDING BACTERIOLOGICAL KEYS, ZOOLOGICAL TABLES AND EXPLANATORY CLINICAL NOTES. By E. R. Stitt, A.B., Ph.G., M.D., Surgeon U.S. Navy; Professor of Medical Zoology, Philippine Medical School, &c. Second Edition, revised and enlarged, with 91 illustrations. London: H. K. Lewis, 136, Gower Street, W.C. 1911.

This useful little work, which approximates closely to a practical handbook on tropical medicine, has now reached a second edition, and deservedly so. The author states in his preface that each section of the book has been carefully revised and much new matter added. The part relating to animal parasitology has been rewritten and almost doubled in extent, and a chapter on poisonous snakes has also been added. In the chapter on "Practical Methods in Immunity," the most recent advances in the Wassermann test and practical agglutination methods have been incorporated, as well as a brief discussion of the question of anaphylaxis. The section on "Clinical Bacteriology and Animal Parasitology of the various Body Fluids and Organs," has been revised to meet the most recent advances in clinical diagnosis, while new methods and several new illustrations have been added. The author has adhered to his plan of making the little volume a practical one, and theoretical considerations have been brought out only when necessary to a proper understanding of some recent or difficult laboratory method. Every effort has been made to keep the book within the limits of a pocket manual. For the naming of the various animal parasites, a strict adherence to the laws of zoological nomenclature has been adopted, and in a very short time now—if others who write books on this branch of medicine will only follow Dr. Stitt's example—a general conformity in names will appear, and the student of the future will have a much easier time than those of the past have had.

Of course, in a work covering such a vast area of medical and zoological ground, minor errors and omissions are bound to creep in, but these, one has no doubt, will finally be dissipated when the student takes up any given subject in detail and studies the literature of it fully. So much is required now of the medical practitioner in the Colonies and other parts of the Tropics, that it is absolutely essential to have some such work as this always by one's hand. The tropical physician is expected to know not only clinical medicine, but also a large amount of zoology, bacteriology, and kindred sciences as well—subjects which are usually dealt with by specialists at home—and in addition has to do his own practical diagnosis in blood work, urine and fæces. To such, a work like this should prove a boon, and one can thoroughly recommend Dr. Stitt's little manual as being eminently practical, and sufficiently full of information for students and others proceeding abroad.

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SALVARSAN ("606"): ITS CHEMISTRY, PHARMACY AND THERAPEUTICS. Martindale and Westcott. London: H. K. Lewis, 1911. 5s. net.

Martindale and Westcott, the well-known authors of the "Extra Pharmacopœia," bring out the above-noted work.

A knowledge of Ehrlich's remedy, the "dioxy-diamino-arsenobenzol," is very necessary now, and that knowledge can easily be gained by a close

perusal of the text under consideration. So far the authors state there has been no complete *résumé* in English dealing comprehensively with this matter, and in their attempts to supply one they tell the reader that they have studied the recent reports on the new compound with assiduity, and have provided concise notes which they think will assist the reader to understand its chemistry, pharmacy, and therapeutics with a minimum of time and trouble. After carefully reading through the book one quite agrees with this statement, and certainly, for any one desiring to get up the details of this new and rapidly extending subject quickly, no better work than this can be found. It should prove of great use to tropical practitioners who usually meet with cases of syphilis in abundance.

## Notes and News.

A SUMMARY of facts regarding malaria suitable for public instruction, written by Major Ronald Ross, C.B., F.R.S., and published by John Murray, Albemarle Street, London, W., gives a succinct account of all it is necessary for the public to know, so as to put them in a position to take an intelligent part in the prevention of malaria. The subject is dealt with under five headings: The Parasites and the Fever, The Mode of Infection, Facts about Mosquitoes, Personal Prevention, Public Prevention. We would recommend any medical man about to undertake a course of instruction to the public to first peruse this instructive pamphlet, and to see that his hearers are all supplied with it. The pamphlet is issued at 2d.

THE editor of the *Giornale di medicina militare*, in a letter dated "Rome," states: "We beg to inform you that the *Giornale medico del Regio esercito*, since January, 1908, has reverted to the original name of *Giornale di medicina militare*."

AUSTRALASIAN MEDICAL CONGRESS (Ninth Session, Syndey, 1911).—The ninth session of the Australasian Medical Congress will be held in Sydney during September, 1911. The session will commence on Monday, September 18, and end on Saturday, September 23. The subscription is one guinea.

*Officers of Congress.*—President: F. Antill Pockley, M.B., C.M. (Edin.), M.B. (Syd.), M.R.C.S. (Eng.), Macquarie Street, Sydney. Treasurer: S. H. MacCulloch, M.B., C.M. (Edin.), College Street, Sydney. General Secretary: Arthur Palmer, M.B., C.M., F.R.C.S.(Edin.), "The Bungalow," Elizabeth Bay, Sidney. Associate Secretary: A. J. Brady, LL.M., K.C.P., L.R.C.S.(Irel.), Liverpool Street, Sidney.

## Annotations.

*Pellagra.*—Fraser B. Gurd, M.D., contributes an interesting paper on the histology of the skin lesions in pellagra in the current number of the *Journal of Experimental Medicine* (vol. xiii., No. 1, January 5, 1911). The cutaneous lesions in pellagra, he states, consist of an early erythema, or, in some cases, of vesicles or bullous formations which are followed by hyperkeratosis and pigmentation, resulting in a dry, dark brown scaliness. The various lesions resemble those produced by the sun, but are much more marked. The histological phenomena of the erythematous and bullous stage are those of a mild acute inflammatory reaction, plus a degeneration in the superficial layers of the corium. Following this degeneration, which involves not only the general connective tissue but the connective tissue of the blood-vessels there is a reparative change evidenced histologically by an increased cellularity of the corium and the presence of fibroblasts. There is an increase also in the number of the capillaries, which become dilated, and the epidermis becomes thickened, this increase being specially marked in the prickle cells and the stratum granulosum.

In the later stages the epithelium dips down deeply into the rarefied connective tissue. Round the blood-vessels during the reactionary process are found collections of lymphoid cells, a few plasma cells, but no mast cells or eosinophiles. Gurd believes that the irritant producing the degeneration in the corium is sunlight, in the presence of some predisposing factor. This is suggested by the enormous increase in pigment formation in the epithelial cells and by the large number of chromatophores in the superficial layers of the corium. The pigmentation is autochthonous in both types of cell. There is no reason for believing that the pigment is formed in the cells of the corium and thence discharged into the epithelium, or that the reverse process takes place.

The predisposing factor inducing the changes in the corium Gurd thinks is apparently due to a lessened resistance of the epithelium to the violet or ultra-violet rays, due to some metabolic insufficiency on the part of the epithelial cells. He further is of the opinion that more extended observations may justify the conclusion that pellagra throughout the body is a disease essentially of the epithelium, including the nervous system, this pathological condition manifesting itself by an insufficient or altered function.

*The Sanitation of Panama.*—McCarthy, in the *Boston Medical and Surgical Journal* for January 12, 1911, contributes a very interesting review of Sanitation in Panama. He shows what the Americans have done in stamping out yellow fever and other tropical diseases on the Isthmus, and how that work has rendered the making of the canal possible. The one disease which is causing more deaths at the present time than any other malady in that area is tubercle, the racial susceptibility and methods of many of the negroes and native Panamarians greatly fostering its spread. While Dr. McCarthy was working in the American Medical wards at Colon Hospital in 1908 he was greatly impressed by the large numbers of

neurasthenics among the American employees. The continued high temperature, the humidity, and the exposure to the hot tropical sun, while working in the open, had, he thinks, a lot to do with this. Most of these patients required at least a week of absolute rest and quiet in the hospital, and another week to convalesce at the Government Sanatorium at Taboga Island. American women, Dr. McCarthy found, did not tolerate the climate of the Isthmus well. One of the most common symptoms noted was menorrhagia, and neurasthenia became common after a prolonged stay of two years or over. These facts he believes justify the conclusion that climatic conditions alone are enervating enough to prevent the white race from ever getting a permanent foothold on tropical regions, and dispute the claims of some sanatarians that the Tropics will soon be a paradise for the white race.

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*The Treatment of Syphilis.*—Dr. Pusey, of Chicago, in the *Journal of the American Medical Association* for January 14, 1911, writes critically on the situation as regards "salvarsan" or "606" in the treatment of syphilis. He believes that indications are present, that we are on the verge of a period of indiscriminate and reckless use of the new remedy which will give rise to great disappointment. He admits the striking effect of "606" on spirochætes, but at the same time points out that mercury may act exactly in the same manner, and the disappearance of spirochætes from a chancre he shows cannot be looked upon as evidence of the cure of the disease. He emphasizes very strongly that the situation with "606" is still experimental—and more experimental than it was thought to be when the drug was introduced. Present experience, he believes, shows that it does not cure syphilis, and that we are not justified in holding out to patients any hope of cure by it, but that it is likely to prove a useful remedy in syphilis, with mercury, however, as before, our chief dependence. Dr. Pusey further claims that the foregoing statement can be abundantly substantiated from the recent literature.

Certainly the hope of a *therapia sterilisans magna* is practically abandoned, and though the drug has proved, and may continue to prove, of great value in the treatment of certain cases that have resisted other treatment, yet it is quite possible that mercury may assert itself once again and the new drug become subservient to it.

Dr. Pusey, in sounding this word of warning, is doing the proper thing, and it would be well if many who are rushing to inject "606" would first study the literature of the subject carefully and also warn their patients that, though injecting them, they cannot promise them a definite cure for their malady.

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*The Habits of Glossina fusca.*—Dr. Meredith Sanderson, a medical officer of the Nyasaland Protectorate, contributes some notes on *G. fusca* to the *Bulletin of Entomological Research* for January, 1911. His notes were based on observations made during the months of June and July, in and near the Songwe Valley. Between Karonga and the River Songwe the country consists of a plain about 10 miles in width, and this is crossed by numerous rivers and streams rising from the hills and running into the lake. The banks of these are covered with thick bush and large trees, and here the fly was found in contra-distinction to the plain, though the natives state that it is also very prevalent there during the rains. *G. fusca*, Dr. Sanderson states, is on the wing, and desirous of feeding at two periods of the day only, viz., in the early morning and in the evening, and if not searched for at these times its presence might remain unsuspected. During the day they are found under leaves of bushes or in the grass, and always near the ground—they often continue to bite some time after dark. In the morning and evening they may be present in large numbers and specimens can easily be obtained at these times. At a village on the Ponga stream Dr. Sanderson found the cattle infected with a trypanosome resembling *Nagana*. Here *G. fusca* was present in large numbers, two specimens actually being caught in a hut in which an infected cow was lying. An investigation of this form of trypanosomiasis would be interesting, and Dr. Sanderson hopes to be able to do this later on.

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*Polycythemia.* — In the *Bulletin of the Manila Medical Society*, for December, 1910, Captain C. B. Snyder, Medical Corps, U.S.A., reports a case of polycythemia. The case occurred in an American soldier, the patient complaining of exhaustion after slight physical exertion, of attacks of giddiness and faintness, and of a painful dragging sensation in the left hypochondrium. He had also suffered from a cough for the last seven months. A blood examination gave the following count: Red corpuscles, 10,600,000 per c.m., white corpuscles 18,000, hæmoglobin 120 per cent. The spleen was greatly enlarged, reaching almost to the umbilicus. The case is rather a good example of Osler's chronic cyanotic polycythæmia, with enlargement of the spleen. In the differential diagnosis of this condition it is necessary to exclude chronic cardiac disease with emphysema, primary tuberculosis of the spleen, and chronic poisoning with the coal tar products. These were all absent in the case under consideration. Captain Snyder gives the average duration of life after the onset of symptoms as three to six years, with three months and ten years as extremes. The prognosis as to cure he believes is bad, and X-rays probably form the best treatment.

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*Pellagra.*—Tucker, in the *Journal of the American Medical Association* for January 28, 1911, writes on Pellagra, basing his remarks on the analytical study of fifty-five non-institutional or sporadic cases. He concludes from his statistics that:—

(1) Pellagra may occur at any age from childhood to old age.

(2) In the Southern states, although the negro forms the majority of the lower class, yet pellagra is most common in the white.

(3) The disease, while affecting chiefly the lower classes, is occasionally seen among those of good hygienic and social surroundings.

(4) The disease is widely spread, and does not occur in local epidemics.

(5) The disease in the cases reported is more common in rural districts than in the cities.

(6) The majority of cases occur in the spring and early summer.

(7) The gastro-intestinal symptoms, especially the diarrhœa, are usually the first manifestations of the disease.

(8) The ingestion of maize or maize products, whether spoiled or not, is not alone the cause of pellagra.

(9) Patients whose constitutions are depleted by pernicious habits or chronic diseases are not rendered thereby more susceptible to pellagra than those not so affected.

(10) The backs of the hands are always affected in the cutaneous lesions of pellagra, and the lesions are always symmetrical.

(11) Exposure to the sun cannot account for the the cutaneous lesions.

(12) Stomatitis is almost a constant symptom.

(13) The nervous and mental symptoms conform to no known nervous disease or form of insanity.

(14) The nervous and mental symptoms form no distinct clinical entity.

(15) The eye symptoms are not pathognomonic.

(16) Emaciation is practically constant.

(17) The special senses are only occasionally affected.

(18) Pellagra is not *per se* a febrile disease, and when an elevation of temperature occurs, it may frequently be accounted for by a complication.

(19) A moderate anæmia is found in most of the cases.

(20) The heart, lungs, and genito-urinary organs do not seem to be particularly affected by pellagra.

(21) Examinations of the urine, fæces, and blood show nothing pathognomonic of pellagra.

(22) The cause of pellagra is unknown, and the study of these cases throws no positive light on the etiology. Patients may have pellagra who do not eat corn products. Sunlight does not account for the condition. In these cases no parasite, toxin, bacteria, nor insect has been isolated as being the causative factor.

(23) The disease is not communicable by ordinary contact.

(24) Three great systems are affected: the digestive tract, the cutaneous surface and the cerebrospinal and peripheral nervous systems and their involvement seems to be in the order named.

(25) Remissions occur in over half of the cases.

(26) Death frequently occurs in the first attack.

(27) It is too early in the study of the disease in this country to estimate the mortality. Probably 50 per cent. die during the first two years.

(28) In these cases it cannot be said that any patient is more than apparently cured, as it may simply be a remission.

(29) No specific cure for the disease has been found, and the remedies in general use are of doubtful value. Hexamethylenamin may possibly have curative properties.

As regards etiology he believes that this is doubtful. In the same number of the Journal a discussion on Pellagra is reported. From the remarks of the speakers, it is evident that this disease is much more prevalent in the States than has usually been supposed.

*Blackwater Fever.*—The question of the specific nature of blackwater fever has long been mooted, but has not been definitely proved. Charles F. Craig returns to the subject in the January number (January 15, 1911), of the *Archives of Internal Medicine*. A supporter of the *sui generis* theory, he gives a general review of the subject, with the time-honoured arguments for and against. He concludes that hæmoglobinuric fever is not due to malaria, because of its geographical distribution; by the fact that it occurs in individuals who have never suffered from malaria, and by the fact that in many instances, neither before, during, or after an attack, can plasmodia be demonstrated in the blood; while, even at autopsy, no trace of malaria can be found. For the following reasons he believes that blackwater fever is due to a specific organism. Its geographical distribution, its numerical disproportion to malaria, wherever it occurs; its occurrence in epidemics, the character of the pathological lesions, its symptomatology, the lack of conclusive evidence that it is due to malaria, and its analogy with other well-known infectious diseases. Much can be said on both sides of the question, but it is suggestive that those who have had the greatest experience of the disease are all, or nearly all, inclined to the view that malaria plays a part in its production. A very large majority of blackwater fever cases have had previous malaria—so many, in fact, that very definite proof from experienced individuals would be required in all supposed negative cases. However, pages could be written for and against the different theories without advancing our knowledge of the subject in the slightest degree. In many ways blackwater fever does look like a disease *sui generis*, but the only way to prove this will be by practical work on cases, not by theorising on the subject at home.

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*The Treatment of Yaws with* "606."—Strong in the *Philippine Journal of Science* for October, 1910 (vol. v., no. 4), describes the treatment of yaws with dioxy-diamido-arsenobenzol, Ehrlich's "606." Recently, it will be remembered, Castellani in Ceylon also described a similar treatment, acute early cases being considerably benefited by the drug, while chronic cases though improved were not definitely cured. Professor Ehrlich sent samples of his drug to both these observers for trial in syphilis and yaws. Dr. Strong now reports his results, twenty-five cases in all having been studied and treated. His results would seem to be better than those of Castellani, being so good, in fact, that he (Dr. Strong) believes "606" to be a definite specific for this disease. Three or four days, he states, after the injection of the drug, the granulomatous lesions begin to disappear and in the course of from ten to twenty days they usually have disappeared entirely, leaving a perfectly smooth, pigmented skin where the lesions previously existed. The absorption of tumour masses measuring several centimetres in diameter and about a centimetre in thickness in so short a time, and under the influence of no local treatment whatever, has been very striking and surprising. Indeed, in the severe cases the disappearance of the lesions and the cures produced must be looked upon as marvellous. Even

in cases where large granulomatous masses or deep ulcerations existed, these were healed within from two to four weeks. None of the cases treated have shown any signs of relapse, although they received but a single injection, and over four months have elapsed now since most of them were inoculated. Dr. Strong believes, however, that in a few of the most severe instances of the disease, where the ulcerations are extensive and of long standing, a second inoculation given about three weeks after the first one may be advisable. The dose of the preparation for the treatment of yaws should be from 0·25 to 0·3 gramme for children and from 0·4 to 0·5 gramme for adults, smaller amounts probably not giving such favourable results.

In conclusion, Dr. Strong states that he does not know of any more striking example in medicine of a specific action than of that produced by dioxy-diamido-arsenobenzol on the lesions of yaws, and he believes that its action may be compared even with that of quinine in malaria and mercury in syphilis.

## Personal Notes.

COLONIAL MEDICAL SERVICES.

*West African Medical Staff.*

*No Deaths.*

*Resignation.* — R. Cope, M.R.C.S.Eng., M.R.C.P.Lond., D.T.M.Liverpool, Medical Officer, Gold Coast, resigns his appointment.

*Retirement.*—E. J. Kelleher, L.R.C.S., L.R.C.P.Edin., L.F.P.S.Glas., Medical Officer, Southern Nigeria, retires temporarily on pension.

*No Transfers.*

*No Promotions.*

*New Appointments.*—The following gentlemen have been selected for appointment to the Staff: L. H. Booth, M R.C.S. Eng., L.R.C.P.Lond., formerly Assistant Surgeon in the Bahamas, Southern Nigeria; J. Donnelly, M.B., B.Ch., B.A.O. (R.U.I.), Gold Coast; H. F. Hamilton, M.B., Ch.B.Edin., D.T.M.Liverpool, Gold Coast; A. Hipwell, L.R C.S., L.R.C.P. Irel., D.P.H.Liverpool, D.T.M.Liverpool, Southern Nigeria; P. D. Oakley, M.R C.S.Eng., L.R.C.P.Lond., D.T.M.Liverpool, Gold Coast; G. Rollason, L.M.S.S.A.Lond., Sierra Leone; W. A. Ryan, L.R.C.P., L.R.C.S., L.M Ireland, Gold Coast; E. L. Sieger, M B., Ch.B.Glas., D.T.M.Liverpool, Southern Nigeria; A. J. Smith, M.B., Ch.B.Birm., Gold Coast; W. G. Watt, M B., Ch.B.Aberd., D.P.H.Aberd., Gold Coast.

*Other Colonies and Protectorates.*

F. L. Boag, M.B., Ch.B.Vict., has been selected for appointment as a Medical Officer in the Gilbert and Ellice Islands Protectorate.

G. C. M. Davies, L.S.A.Lond., L.R.C P.Edin., has been selected for appointment as a Medical Officer in the British Solomon Islands Protectorate.

COLONIAL CIVIL SERVICE.

Dr. J. C. McPherson, Supernumerary Medical Officer, Leeward Islands, has been confirmed in the service of that Colony, and will be stationed in the first instance at Anguilla, in succession to Dr. W. F. Samuels. Dr. McPherson has also been appointed Magistrate and Coroner of District K, Anguilla, and has assigned to him the duties of a Sub-Accountant of the St. Kitts Treasury.

Dr. Angus McDonald, formerly Officer of Health in Crewe, has been selected for the appointment of Health Officer in Kingston, Jamaica, in succession to Dr. Ogilvie.

Dr. W. Lutsch has been appointed to the post of District Surgeon, Lindley, in the Province of the Orange Free State, South Africa.

Dr. Tom Bishop is acting as a Government Medical Officer of the Gambia Colony.

Dr. G. D. Freer, Senior Medical Officer, Selangor, has been made Senior Medical Officer, Selangor, Negri Sembilan, and Pahang, Federated Malay States.

Dr. J. D. Helmcken has been appointed Physician at the Provincial Gaol, Victoria, British Columbia, in the piace of Dr. J. S. Helmcken, who has resigned.

## Recent and Current Literature.

*A list of recent publications and articles bearing on tropical diseases is given below. To readers interested in any branch of tropical literature mentioned in these lists the Editors of the* JOURNAL OF TROPICAL MEDICINE AND HYGIENE *will be pleased, when possible, to send, on application, the medical journals in which the articles appear.*

**"Boston Medical and Surgical Journal," December 29, 1910.**

Coriat reports a very interesting case of trichinosis in a man in which symptoms resembling myotonia occurred. The symptom-complex of myotonia, as he states, is usually found only in childhood. Eight years before the patient came under observation there had been a history of a severe gastro-intestinal attack. Shortly afterwards a stiffness was noticed in the right leg, followed by a weakness of the muscles of the right foot. Finally, the left leg and foot became affected. On examination, the calf muscles were seen to be thin and flabby. At first the foot could be flexed and extended rapidly, but then the movements became slower and more difficult, and then almost ceased, the calf muscles becoming hard and rigid. Walking produced the same effect. The correct diagnosis was reached by excising and sectioning pieces of the muscle, the larvæ of the *Trichina* being found.

**"Archiv für Schiffs-und Tropen-Hygiene" (Band xv., 1911, Heft 1).**

Castellani reports on the use of Ehrlich's "606" in yaws. Having received a sample of the drug from Professor Ehrlich, eight patients were treated with the preparation, six of these being recent cases, presenting the general granulomatous eruption, and two being old cases with late manifestations of the disease. Each patient had one injection only. The patients presenting the general granulomatous eruption recovered, as regards the skin lesions, within two weeks, but one relapsed in a month. The other two, with the late manifestations, were distinctly benefited by the injection, but the lesions were not cured. Castellani concludes that this method of treatment will be of the greatest benefit in framboesia.

**"Bulletin de la Société de Pathologie Exotique" (Tome iii., 1910, No. x).**

Laveran writes on the subject of *Trypanosoma pecorum*, a name recently given by Bruce and his co-workers to a trypanosome found in oxen in Uganda. Sir David Bruce presented Laveran, last October, with two rats inoculated in London with *T. pecorum*, and the author has carried out a series of experiments with the strain, especially comparing it with the *T. congolense* and the *T. dimorphon*. He proposes to carry out further researches, but at present he is satisfied that it cannot be identified with the two species just named, and that therefore it constitutes a new species.

**"Bulletin de la Société de Pathologie Exotique" (Tome iii., 1910, No. x).**

Letulle and Nattan-Larrier write on the histology of climatic bubo. The pathological histology has not been well described so far. uThey find that the characteristic changes found in the b bo are as follows: (1) A displacement of the lymphatic tissue; (2) an excess of plasma cells; (3) an insular necrosis of the reticular tissue. In sections stained by many different methods they could not discover any characteristic organs.

**"Bulletin de la Société de Pathologie Exotique" (Tome. iii., 1910, No. x).**

Nicolas describes a heart of a dog infected with adult filaria, and three specimens of microfilaria from human subject's blood, all of these being from New Caledonia.

Railliet and Henry, who discussed the paper, stated that the filaria in the dog's heart was the *Filaria immitis*, but that there was insufficient evidence to say what the embryonic filaria from the human blood were. The case from which they came was suffering from chyluria, and so very likely they were just the embryos of *Filaria bancrofti*, but their measurements were much smaller than those usually found in that species.

**"The Sleeping Sickness Bulletin."**

The "Sleeping Sickness Bulletin" for January, 1911 (vol. 3, No. 23), edited by Dr. A. G. Bagshawe, contains the following annotations and articles: A Case of Trypanosomiasis; Symptoms; Chemotherapy; The Human Trypanosome of Rhodesia; Human Trypanosomiasis and Syphilis; Trpanosomes and tsetse-flies; Covering Disease of Horses; Surra; Figures of Different Trypanosomes, and general sleeping sickness news, with a monthly list of references.

**"Interstate Medical Journal," January, 1911.**

The January number of the above journal is devoted to a special number on syphilis. Some of the papers deal, as would be expected, with the new treatment of the disease by Ehrlich's "606," but in addition there are others of merit on other aspects of the subject. Sanitary regulation for dealing with venereal disease is very well described and criticized by Morrow, and all interested in the subject of the State control of venereal diseases and syphilis generally might well consult the number in the original with advantage.

**"New York Medical Journal," January 14, 1911.**

Wiener, of New York, describes a case of toxic hæmatoporphyrinuria complicating a septic perforation of the uterus. The hæmatoporphyrinuria was caused by excessive doses of saffron taken for the purpose of procuring an abortion, the injury to the uterus being caused by the patient herself, with a hard rubber tube, after the drug had failed to have the desired effect. With the severe peritonitis that was present it was not easy to say to what extent the drug toxæmia contributed to the fatal issue. Hæmatoporphyrinuria has been found heretofore in sulphonal, trional, tetronal and lead poisoning, and in various diseases.

**"Boston Medical and Surgical Journal," January 5, 1911.**

Major Russell, of the Medical Corps of the United States Army, writing on the prevention and treatment of typhoid fever with antityphoid vaccine, believes that the following conclusions are justified. Typhoid has invariably appeared in armies in the past and may be expected in the future. The usual prophylactic measures are only partially available in camps. Vaccination is simple and harmless, and wherever used has reduced the incidence and mortality of typhoid—the immunization of every individual in the army is perfectly feasible, and it offers the greatest hope of freedom from this plague in the future. Antityphoid inoculation has long since passed the experimental stage. Since 1904, 60,000 men have been vaccinated in India, over 70,000 in South West Africa, and over 14,000 in the United States, and in no case has any harm followed its administration. The time has come, therefore, Major Russell believes, when its use should be extended, not merely in the military services, but also among the civil populations.

**"The Bulletin of Entomological Research" for January, 1911 (vol. i. Part 4. Pp. 233-320),**

Contains the following original articles:—

(1) On tabanidæ collected in North-Eastern Rhodesia and Katanga, Congo Free State, by Dr. S. and Mr. S. A. Neave, with the description of new species, by Mr. E. E. Austen.

(2) "A New Species of tabanus from the Anglo-Egyptian Sudan," by Mr. E. E. Austen.

(3) "A New Species of Tsetse Fly allied to *Glossina palpalis*," by Mr. E. E. Austen.

(4) "The Prevalence, Distribution and Significance of *Stegomyia fasciata* in West Africa," by Sir Rubert Boyce.

(5) "Some observations on the Bionomics of *Tabanus ditæniatus* and *T. kingi*," by Mr. Harold H. King.

(6) "Report on a Journey to the Luangwa Valley, North Eastern Rhodesia, from July to September, 1910," by Mr. S. A. Neave.

(7) "Notes on *Glossina fusca* in North Nyasa," by Dr. Meredith Sanderson.

**"British Medical Journal," January 28, 1911.**

Dr. A. Cretien reports a case of infantile kala-azar in Malta. The patient was an infant aged 3 years, and had been ill for seven months. The clinical manifestations were pallor, moderate emaciation, fever of a remittent type, lymphatic glands slightly enlarged, spleen enlarged down to level of umbilicus, bronchial catarrh, and diarrhœa of a dysenteric type. Examination of the splenic tissue showed Leishman-Donovan bodies, and these were also demonstrated in smears from mucous flakes excreted with the fæces. Dr. Cretien believes that this is the first time that the examination of excreta of patients suffering from Leishmaniosis has been attended with positive results, as regards the demonstration of the pathogenic protozoa.

**"Bulletin de la Société de Pathologie Exotique," January 11, 1911.**

Conor believes that he has demonstrated the existence of *Filaria perstans* in Tunis. He found filarial embryos in the urine of a case who had always lived at the oasis of Gafsa. These embryos, he states, measured 150 $\mu$ in length, by 7 $\mu$ in breadth; they had no sheath, but on staining, the cuticle was finely striated. Numerous examinations of the blood by night and day were always negative. The grounds for concluding that these embryos are *F. perstans* are totally inadequate, and the measurements and anatomy would indicate, that whatever else they may be, they are certainly not that parasite.

**"Medical Record," January 21, 1911.**

Darling, Clinical Professor of Surgery in the University of Michigan, reports a case of a non-parasitic cyst of the spleen for which he performed the operation of splenectomy. Such cysts, he states, are not common. The cyst was in the upper part of the spleen, being attached to the omentum and diaphragm by adhesions. It contained a chocolate-coloured fluid and crenated blood corpuscles, the appearance of the sac and its contents leading to a belief that the lesion was formed by hæmorrhage. In the removal of the spleen the separation of adhesions from the diaphragm caused some hæmorrhage, otherwise the operation was uneventful. The patient made a good recovery and is well at the present time, one year after the operation.

## Notices to Correspondents.

1.—Manuscripts sent in cannot be returned.

2.—As our contributors are for the most part resident abroad, proofs will not be submitted to those dwelling outside the United Kingdom, unless specially desired and arranged for.

3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.

4.—Authors desiring reprints of their communications to the JOURNAL OF TROPICAL MEDICINE AND HYGIENE should communicate with the Publishers.

5.—Correspondents should look for replies under the heading "Answers to Correspondents."

## Original Communication.

# EXPERIMENTS TO ASCERTAIN IF ANTELOPE MAY ACT AS A RESERVOIR OF THE VIRUS OF SLEEPING SICKNESS (*TRYPANOSOMA GAMBIENSE*).[1]

By Colonel Sir DAVID BRUCE, C.B., F.R.S., A.M.S.,

AND

Captains A. E. HAMERTON, D.S.O., and H. R. BATEMAN, R.A.M.C.

*Sleeping Sickness Commission of the Royal Society, Uganda, 1908-10.*

### INTRODUCTION.

THE question of a reservoir of the virus of sleeping sickness, other than man and his domestic animals, is of the utmost importance.

Now man and the domestic animals have been removed from the Lakeshore of the mainland for some two and a half years, and from the islands since September, 1909. The effect of this depopulation has been to make a two-mile area along the northern shores of the Lake virtually a game reserve, in which water-buck, bush-buck, reed-buck, Speke's *Tragelaphus*, hippopotami, wild pig, and other large game abound. The game water freely at the Lakeshore, and small herds of antelope may frequently be seen grazing on the grassy hillsides overlooking the Lake.

Notwithstanding removal of man and his domestic animals, the Lakeshore *Glossina palpalis* continued to infect susceptible animals with sleeping sickness up to the end of March, 1910. The Commission, therefore, endeavoured to find answers to the following questions:—

(1) Can antelope be infected with sleeping sickness by the bites of laboratory-bred and laboratory-infected *G. palpalis*?

(2) If antelope can be infected with the virus of sleeping sickness, can they transmit the infection to laboratory-bred *G. palpalis* when these flies are allowed to feed upon them? Further, if these *G. palpalis* become infected, can they transmit the virus to susceptible animals?

(3) If these *G. palpalis* become infected with the virus of sleeping sickness, what percentage are so infected?

(4) How does sleeping sickness affect the health of the antelope?

(5) Lastly, are antelope living in the fly-area naturally infected with sleeping sickness?

Should all these questions be answered in the affirmative, the importance of the observation is patent. The continued infectivity of the flies on the Lakeshore would be explained. Whilst the movements of man and the domestic animals can, to some extent, be controlled by administrative measures, the movements of antelope in search of new grazing grounds would be almost impossible to check, owing to the difficult nature of the forested and elephant-grass country which in so many parts borders the Uganda shores of the Lake. Game laws would require modification, and the destruction of the game in the neighbourhood of the lakes and *palpalis*-frequented rivers would become a factor in the control of sleeping sickness.

To answer the above queries the following experiments were devised and carried out:—

### (1) CAN ANTELOPE BE INFECTED WITH SLEEPING SICKNESS BY THE BITES OF LABORATORY-BRED AND LABORATORY-INFECTED *Glossina palpalis*?

Eleven buck in all were employed in this experiment. Four bush-buck (*Tragelaphus sylvatica*?), six reed-buck (*Cervicapra arundinacea*), and one water-buck (*Cobus defassa*). Other buck, such as "oribi" (*Cephalophus grimmi*) and "entalaganya" (*Cephalophus equatorialis*), were obtained by the Commission, but did not survive long in captivity.

As each buck arrived its blood was usually injected, subcutaneously, into monkeys or rats, to ascertain if the blood was naturally infected with trypanosomes. The method then adopted in each case to infect the antelope with sleeping sickness was as follows: A cage of clean[2] laboratory-bred *G. palpalis* was fed on a monkey known to be infected with a *human strain* of *Trypanosoma gambiense*. This case of artificially-infected flies was then fed on healthy animals until one of the animals (monkeys) became infected with sleeping sickness. Having proved that the flies were infective, the cage of flies was then fed, about five minutes daily, for several days, on one or other of the buck. The buck's blood was then examined daily for trypanosomes, and was further tested for sleeping sickness by its inoculation into monkeys or rats.

The experiments follow in full detail.

*Experiment* 2328. *Bush-buck.*

This bush-buck was fed on for five days (March 24, 25, 26, 28 and 29, 1910) by laboratory-bred *G. palpalis* which were known to be infected with a *human strain* of *T. gambiense*.

On April 8, fifteen days after the first feed of the infected flies on this buck, 5 c.c. of the buck's blood were injected, subcutaneously, into a healthy monkey.

April 10, monkey showed *T. gambiense* in its blood. The trypanosomes were verified by examinatiou in fresh and stained preparations of the blood.

*Result.*—Positive.

*Remarks.*—The preliminary inoculation of the blood into susceptible animals, to ascertain if the buck's blood naturally harboured trypanosomes, was not made in this case. Though examined almost daily from March 29 to August 5, 1910, *T. gambiense* was never seen in the blood of this antelope. Fresh and stained blood-films were made and examined. On one occasion only—April 20—*Trypanosoma ingens* was seen in a fresh preparation. Monkeys are not inoculable with this parasite.

*Experiment* 2357. *Reed-buck.*

April 8, 1910, 5 c.c. of this buck's blood were injected, subcutaneously, into a normal monkey, to ascertain if buck's blood naturally harboured trypano-

[1] A communication read before the Royal Society, January 19, 1911.

[2] The word "clean," applied here and throughout this paper to laboratory-bred *G. palpalis*, means flies which have newly hatched out from pupæ in the laboratory and have never fed.

somes. This monkey's blood was examined bi-weekly for a month. Monkey remained healthy, no trypanosomes appearing in its blood.

Buck was fed on for twelve days, between April 7 and 20, 1910, by laboratory-bred *G. palpalis* known to be infected with a *human strain* of *Trypanosoma gambiense*. On the 13th day after the first feed of these flies, 3 c. c. of the buck's blood were inoculated into a normal monkey. Examined bi-weekly for a month this monkey remained healthy.

*T. gambiense* having appeared in the buck's blood on May 2, a further inoculation of 5 c.c. of its blood was made into a normal monkey on this date. This monkey showed *T. gambiense* in its blood on May 10.

*Result.*—Positive.

*Remarks.*—This reed-buck was evidently free from any trypanosome infection inoculable into monkeys on its arrival at the laboratory. *T. gambiense* appeared for the first time in the buck's blood in scanty numbers on May 2, 1910, twenty-five days after the first feed of the supposed infective *G. palpalis*. On May 3 and 4, the trypanosomes were fairly numerous in the blood, and on the 5th and 6th scanty numbers only were seen. After May 6, *T. gambiense* was never again seen in the blood, though examined for almost daily up to August 5, 1910. The long period of twenty-five days which elapsed between the first feed of the supposed infected *Glossina* and the appearance of the trypanosomes in the buck's blood may be accounted for by the supposition that the infected fly or flies in the cage which was fed on the buck from April 7 to April 19 had died before they had fed on the buck. On April 20, a fresh cage of *G. palpalis*, known to be infected with a *human strain* of *T. gambiense* was fed, once only, on this buck, and on the twelfth day after this feed, on May 2, trypanosomes appeared in the buck's blood. This supposition is probably correct, and further accounts for the failure of the inoculation on April 20.

*Experiment* 2359. *Reed-buck.*

On April 8, 1910, 5 c.c. of this buck's blood were injected, subcutaneously, into a normal monkey, to ascertain if buck's blood naturally harboured trypanosomes. This monkey's blood was examined bi-weekly for a month. Monkey remained healthy.

Buck was fed on for six days (April 25 to 30, inclusive) by laboratory-bred *G. palpalis* known to be infected with a *human strain* of *T. gambiense*.

On May 6, the eleventh day after flies' first feed, *T. gambiense* appeared in buck's blood in fair numbers, and 5 minims were injected, subcutaneously, into normal white rat. On May 11 this rat showed *T. gambiense* in its blood.

*Result.*—Positive.

*Remarks.*—This reed-buck was evidently free from any trypanosome infection inoculable into monkeys on its arrival at the laboratory. *T. gambiense* appeared for the first time in its blood in fair numbers on May 6, 1910, again on 7th, not examined for on 8th, scanty on 9th, absent on 10th, scanty on 11th, very numerous on 12th, and never seen again, though examined for almost daily, till August 5.

*Experiment* 2371.—*Bush-buck.*

On April 13, 1910, 5 c.c. of this buck's blood were injected, subcutaneously, into a normal monkey, to ascertain if buck's blood naturally harboured trypanosomes. This monkey's blood was examined bi-weekly for a month. Monkey remained healthy.

Buck was fed on for eight days (April 22 and 23, and from April 25 to 30, 1910, inclusive), by laboratory-bred *G. palpalis* known to be infected with a *human strain* of *T. gambiense*.

On May 4, the twelfth day after the infected flies' first feed on the buck, *T. gambiense* appeared in the buck's blood in fair numbers.

On May 5, trypanosomes were numerous, and 2 c.c. of the buck's blood were injected, subcutaneously, into a normal monkey. On May 13 this monkey showed *T. gambiense* in its blood.

*Result.*—Positive.

*Remarks.*—Buck was free from trypanosomes inoculable into a monkey on its arrival at the laboratory. *T. gambiense* appeared in buck's blood for the first time, in scanty numbers, on May 3, 1910, and again in fair numbers on May 4; thereafter no trypanosomes were seen up to August 5, 1910, though the blood was almost daily examined.

*Experiment* 2378. *Water-buck.*

On April 13, 1910, 5 c.c. of this buck's blood were injected, subcutaneously, into a normal monkey, to ascertain if the buck naturally harboured trypanosomes in its blood. This monkey was examined bi-weekly for one month; monkey remained healthy.

Buck was fed on for eight days (April 22, 23, 25 to 30, inclusive) by laboratory-bred *G. palpalis* known to be infected with a *human strain* of *T. gambiense*. *T. gambiense* was never seen in this buck's blood, though examined for almost daily from April 22 to August 5, 1910.

On May 5, 5 c.c. of the buck's blood were injected, subcutaneously, into a normal monkey, an interval of thirteen days having elapsed since first feed of the infected flies. This monkey showed *T. gambiense* in its blood on May 13, 1910.

*Result.*—Positive.

*Remarks.*—Buck was free from trypanosomes inoculable into a monkey on its arrival at the laboratory. Though *T. gambiense* never appeared in the buck's blood, yet a positive result was obtained on its inoculation into a monkey, and, as will be seen below (Table II), clean laboratory-fed flies fed on this buck for several days became infected with *T. gambiense*.

*Experiment* 2427. *Reed-buck.*

On May 4, 1910, 1 c.c. of this buck's blood was injected, subcutaneously, into a normal white rat. This rat, examined bi-weekly, for one month, remained healthy.

Buck was fed on for six days (May 2 to 7 inclusive) by laboratory-bred *G. palpalis* known to be infected with a *human strain* of *T. gambiense*.

On May 9, the seventh day after infected flies' first feed on the buck, *T. gambiense* appeared in scanty numbers in its blood for the first time. One cubic

centimetre of the blood was then injected, subcutaneously, into a normal white rat. On May 16, *T. gambiense* appeared in this rat's blood.

*Result.*—Positive.

*Remarks.*—On its arrival at the laboratory the buck was free from trypanosomes inoculable into a rat. A few *T. gambiense* appeared for the first time on May 9, 1910, in buck's blood; they were present in fair numbers on the 10th, scanty again on the 11th, and were seen for the last time in fair numbers, on May 12. Almost daily blood examinations were made, with negative results, up to August 5, 1910.

*Experiment* 2428. *Bush-buck.*

On May 4, 1910, 1 c.c. of this buck's blood was injected, subcutaneously, into a normal white rat. This rat remained healthy, its blood being examined for one month after the injection.

Buck was fed on for thirteen days (May 2 to 16, inclusive, May 9 and 15 being excepted) by laboratory-bred *G. palpalis* known to be infected with a *human strain* of *T. gambiense*. *T. gambiense* was never seen in this animal's blood, though examined for almost daily from May 4 to August 5, 1910.

On May 16, fourteen days after infected flies first fed on the buck, a few drops of the buck's blood were injected, subcutaneously, into a normal white rat. This rat showed *T. gambiense* in its blood on May 23. No trypanosomes were ever seen in buck's blood.

*Result.*—Positive.

*Remarks.*—On its arrival at the laboratory the buck was free from trypanosomes inoculable into a rat. No trypanosomes were ever seen in the buck's blood, nevertheless its blood was infective on inoculation, and, as will be seen later (Table II), capable of infecting clean laboratory-bred *G. palpalis*.

*Experiment* 2429. *Reed-buck.*

On April 13, 1910, 5 c.c. of this buck's blood were injected, subcutaneously, into a normal monkey. This monkey remained healthy, its blood being examined bi-weekly for a month after the injection. On May 3, 1910, 1 c.c. of the buck's blood was injected, subcutaneously, into a normal rat. This rat remained healthy, its blood also being examined bi-weekly for a month after the injection.

The buck was fed on for eight days (May 2 to 7, and 9 and 10 inclusive) by *G. palpalis* known to be infected with a *human strain* of *T. gambiense*.

On May 11, the ninth day after the infected flies' first feed on the buck, *T. gambiense* appeared in scanty numbers in its blood for the first time. On May 13, the trypanosomes being numerous in the blood of the buck, a few drops of the blood were injected, subcutaneously, into a normal white rat. This rat showed *T. gambiense* in its blood on May 17.

On July 2, 1910, this buck accidentally broke its leg and had to be killed, 4 c.c. of its heart's blood being injected into a normal monkey. This monkey showed *T. gambiense* in its blood on July 12.

*Result.*—Positive.

*Remarks.*—On its arrival at the laboratory the buck was free from trypanosomes inoculable into monkeys or rats. *T. gambiense* appeared in its blood for three days—on May 11 for the first time, in scanty numbers; on May 12, many; and on May 13, very many—therefore no trypanosomes were seen, though almost daily examinations were made up to July 2, 1910. It will be noted that the buck's blood was still infected with *T. gambiense* on July 2—that is, 50 days after the last date (May 13) that trypanosomes were seen in it.

*Experiment* 2431. *Reed-buck.*

On May 3, 1910, 1 c.c. of this buck's blood was injected, subcutaneously, into a normal white rat. Rat remained healthy, its blood being examined bi-weekly for a month after the injection.

The buck was fed on for six days (May 2 to 7, inclusive) by laboratory-bred *G. palpalis* known to be infected with a *human strain* of *T. gambiense*.

On May 12, 1910, the tenth day after the infected flies' first feed, *T. gambiense*, in scanty numbers, appeared for the first time in the blood of the buck. On May 13, the trypanosomes being numerous in the blood of the buck, a few drops of its blood were injected, subcutaneously, into a normal white rat. This rat showed numerous *T. gambiense* in its blood on May 20.

*Result.*—Positive.

*Remarks.*—On its arrival at the laboratory the buck was free from trypanosomes inoculable into rats. *T. gambiense* appeared in the buck's blood, in scanty numbers, for the first time on May 12, and were present in large numbers on May 13 and 14.

We have now to record one of the most important and suggestive observations in this series of experiments. *From May 14 to June 27 the blood was examined almost daily, and on the latter date—June 27—forty-four days after trypanosomes were last seen,* T. gambiense *reappeared for one day in this buck's blood in fair numbers.* Their identity was established by careful examination in wet and stained preparations of the blood.

(N.B.—Two mechanical transmission experiments were carried out with this buck. In the first, 50 flies were used and were fed on the buck for the three days the trypanosomes were seen in its blood. *Result.*—Negative. In the second, 100 flies were used, and were fed for four days on the buck. No trypanosomes were seen in the buck's blood during these days. *Result.*—Negative. In the first experiment four hours, and in the second one hour, elapsed between the feed on the buck and the feed on the healthy monkey.)

*Experiment* 2445. *Reed-buck.*

No preliminary inoculation of this buck's blood was made on its arrival at the laboratory.

The buck was fed on for seven days (May 6 and 7, and 9 to 13, inclusive) by laboratory-bred *G. palpalis* known to be infected with a *human strain* of *T. gambiense*.

On May 14, 1910, the eighth day after the infected flies' first feed, *T. gambiense* appeared in the blood of the buck for the first time. On May 20 the buck died, and a small quantity of its heart's blood was injected, subcutaneously, into a normal white rat. On June 2 rat showed *T. gambiense* in its blood. (This rat was overlooked from May 24 to June 2, and its blood was not examined between these dates.)

*Result.*—Positive.

*Remarks.*—The blood of this buck was (with the exception of May 8) examined daily from May 6 to 13 with negative results for trypanosomes. On May 14, *T. gambiense* appeared for the first time in its blood in scanty numbers; on the 16th, 17th and 18th, they were very numerous; on the 19th they were again scanty, and on the day of death, May 20, 1910, no trypanosomes could be found, the peripheral and heart's blood being examined.

Table I. gives results of feeding infected *G. palpalis* on healthy antelope.

TABLE I.

| No. of experiment | Species of antelope | No. of days infected flies fed | No. of days before trypanosomes appeared | Result | | Remarks |
|---|---|---|---|---|---|---|
| | | | | Positive | Negative | |
| 2328 | Bush-buck.. | 5 | — | + | — | Trypanosomes never seen. |
| 2357 | Reed-buck.. | 12 | 25 | + | — | |
| 2359 | ,, .. | 6 | 11 | + | — | |
| 2371 | Bush-buck.. | 8 | 12 | + | — | |
| 2372 | ,, .. | 6 | 8 | + | — | |
| 2378 | Water-buck | 8 | — | + | — | Trypanosomes never seen. |
| 2427 | Reed-buck.. | 6 | 7 | + | — | |
| 2428 | Bush-buck.. | 13 | — | + | — | Trypanosomes never seen. |
| 2429 | Reed-buck.. | 8 | 9 | + | — | |
| 2431 | ,, .. | 6 | 10 | + | — | |
| 2445 | ,, .. | 7 | 8 | + | — | |

From these experiments it is shown that antelope may be readily infected with sleeping sickness by the bites of artificially infected tsetse-flies. Eleven antelopes were used, and in every case a positive result was obtained. It will be remembered that in similar experiments made with cattle the same result was obtained.

(2) IF ANTELOPE CAN BE INFECTED WITH THE VIRUS OF SLEEPING SICKNESS, CAN THEY TRANSMIT THE INFECTION TO CLEAN LABORATORY-BRED GLOSSINA PALPALIS WHEN THESE TSETSE-FLIES ARE ALLOWED TO FEED UPON THEM? FURTHER, IF THESE GLOSSINA PALPALIS BECOME INFECTED, CAN THEY TRANSMIT THE VIRUS TO SUSCEPTIBLE ANIMALS?

It has now been proved that water-buck, reed-buck, and bush-buck can be infected with the virus of sleeping sickness, with what would seem to be unfailing regularity. Should, however, these antelope be incapable of infecting the *G. palpalis* with *T. gambiense*, the fact is of academic importance only. On the other hand, should the results of feeding clean laboratory-bred *G. palpalis* on these infected buck give positive results when those flies are subsequently fed on normal susceptible animals, a further step has been made in the search for a reservoir of the virus of sleeping sickness, other than man and his domestic animals.

The method adopted to test this second query was carried out as follows; Clean, laboratory-bred *G. palpalis* were fed for several days on an infected buck. After an interval of starvation of twenty-four hours or more the flies were transferred to healthy animals

TABLE II.—GIVING THE RESULT OF FEEDING LABORATORY-BRED FLIES ON ANTELOPE INFECTED WITH SLEEPING SICKNESS.

| No. of experiment | No. of clean flies used | Species of antelope flies fed on | No. of days flies fed on antelope | No. of days before flies became infective | Result | | Remarks |
|---|---|---|---|---|---|---|---|
| | | | | | Positive | Negative | |
| 2346 | 160 | Bush-buck 2328 .. | 12 | 29 | + | | Buck 2328 never showed *T. gambiense* in blood. In spite of this, flies fed on it became infected 55 days after the buck's infection. |
| 2384 | 100 | ,, ,, .. | 8 | 28 | + | | |
| 2414 | 70 | ,, ,, .. | 6 | 29 | + | | |
| 2501 | 100 | ,, ,, .. | 8 | 39 | + | | |
| 2351 | 100 | Reed-buck 2357 .. | 7 | 41 | + | | Buck 2357 showed *T. gambiense* in its blood for 5 days only. |
| 2500 | 100 | ,, ,, .. | 8 | — | | – | |
| 2510 | 100 | ,, ,, .. | 5 | — | | – | |
| 2507 | 200 | ,, 2359 .. | 6 | 44 | + | | Buck 2359 showed *T. gambiense* in its blood for 7 days only. |
| 2421 | 50 | Bush-buck 2371 .. | 6 | — | | – | Buck 2371 showed *T. gambiense* in its blood for 3 days only. |
| 2477 | 60 | ,, ,, .. | 6 | 29 | + | | |
| 2499 | 100 | ,, 2372 .. | 8 | — | | – | Buck 2372 showed *T. gambiense* in its blood for 2 days only. |
| 2451 | 95 | Water-buck 2378 .. | 6 | 30 | + | | Buck 2378 never showed *T. gambiense* in its blood. |
| 2478 | 60 | ,, ,, .. | 6 | — | | – | |
| 2559 | 50 | ,, ,, .. | 4 | — | | – | |
| 2454 | 110 | Reed-buck 2427 .. | 6 | 24 | + | | Buck 2427 showed *T. gambiense* in its blood for 4 days only. |
| 2456 | 60 | ,, ,, .. | 4 | 33 | + | | |
| 2508 | 100 | ,, ,, .. | 6 | 30 | + | | |
| 2485 | 50 | Bush-buck 2428 .. | 7 | 28 | + | | Buck 2428 never showed *T. gambiense* in its blood. |
| 2460 | 50 | Reed-buck 2429 .. | 4 | 27 | + | | Buck 2429 showed *T. gambiense* in its blood for 3 days only. |
| 2543 | 100 | ,, ,, .. | 6 | 49 | + | | |
| 2464 | 55 | ,, 2431 .. | 3 | 28 | + | | Buck 2431 showed *T. gambiense* in its blood for 4 days only. In spite of this, flies fed on it became infected 81 days after its infection. |
| 2544 | 90 | ,, ,, .. | 6 | 36 | + | | |
| 2592 | 100 | ,, ,, .. | 5 | 43 | + | | |
| 2476 | 50 | ,, 2445 .. | 4 | — | | – | Buck 2445 showed *T. gambiense* in its blood for 6 days only. |

and fed daily. When the healthy animal showed *T. gambiense* in its blood the experiment was stopped, and the surviving flies were dissected as soon as possible.

The result of twenty-four experiments carried out on these lines is given in the preceding table.

On glancing at Table II. it will be seen that 24 experiments in all were carried out. Of these, 17 were positive (70·84 per cent.), and seven negative (29·16 per cent.). The shortest time which elapsed before the flies became infective was 24 days, the longest 49 days, and the average 33·35 days. Compare these results with those detailed in the *Proceedings of the Royal Society*, B, 1910, vol. 82, p. 374, Table III. Of the 42 experiments there described, only 8 (19 per cent.) were positive. The clean laboratory-bred flies were fed on *Trypanosoma gambiense* infected monkeys in 36 of those experiments, in one case on a sleeping sickness patient, and in five cases on oxen infected with the virus of sleeping sickness.

*Experiment* 2501.—*To ascertain if Laboratory-bred* Glossina palpalis *become Infective when Fed on Antelope whose Blood contains* Trypanosoma gambiense.

| Date | Day of experiment | Procedure | Result | Remarks |
|---|---|---|---|---|
| 1910. | | | | |
| May 23—28 | 1—5 | Flies fed 5 minutes daily on bush-buck 2328 | | 100 flies used. |
| May 29 .. | 6 | Flies starved | | |
| ,, 30—31 | 7—8 | Flies again fed 5 minutes daily on buck 2328 | | |
| June 1 .. | 9 | Flies starved | | |
| ,, 2 to July 7 | 10—45 | Flies fed 5 minutes daily on normal monkey 2517 | | July 8, Monkey 2517 shows *T. gambiense* in |
| July 8 .. | 46 | Flies starved, as monkey 2517 shows *T. gambiense* in its blood | + | its blood to-day. Allowing 7 days for incubation of *T. gambiense* in monkey's blood, then the *G. palpalis* became infective on the 39th day after their first infected feed on buck 2328 |
| ,, 9 .. | 47 | The 57 surviving *G. palpalis* dissected; 20·3 per cent. of these flies showed heavy intestinal infection with flagellates (*T. gambiense*) | | |

*Remarks.*—This is the experiment referred to above, where the blood of a buck was capable of infecting clean laboratory-bred flies 55 days after last feed of infected flies on the buck.

Positive results were obtained from all the buck on at least one occasion, with the exception of bush-buck, Experiment 2372, and reed-buck, Experiment 2445. Only two experiments were carried out from these buck, one from each, viz., Experiments 2499 and 2476. In Experiment 2499 the flies were fed on the antelope 19 days after the trypanosomes had disappeared from its blood, as far as microscopical examination went. In Experiment 2476 the flies were non-infective to monkeys up to the 45th day after their first feed on the infected buck. This latter experiment was proceeding when the Commission left Uganda, and a positive result may yet have to be recorded.

The most significant of the above observations is the one in which it is shown that 55 days after the last feed of infected *G. palpalis* on bush-buck, Experiment 2328, the blood of this buck was capable of infecting clean laboratory-bred flies, though *T. gambiense* had never been seen in its blood.

To illustrate how these experiments were carried out, full details of two are given. They are typical of the methods adopted. One positive and one negative experiment have been chosen.

*Experiment* 2499.—*To ascertain if Laboratory-bred* Glossina palpalis *become Infective when Fed on Antelope whose Blood contains* Trypanosoma gambiense.

| Date | Day of experiment | Procedure | Result | Remarks |
|---|---|---|---|---|
| 1910. | | | | |
| May 23—28 | 1—5 | Flies fed 5 minutes daily on bush-buck 2372 | | 100 flies used. |
| ,, 29 .. | 6 | Flies starved | | |
| ,, 30—31 | 7—8 | Flies again fed 5 minutes daily on buck 2372 | | |
| June 1 .. | 9 | Flies starved | | Monkey 2552 was examined bi-weekly from June 13 to August 12. It remained healthy. The surviving *G. palpalis* were not dissected as experiment was negative. |
| ,, 2—11 | 10—19 | Flies fed on cock 2518 | | |
| ,, 12 .. | 20 | Flies starved | | |
| ,, 13 to July 12 | 21—50 | Flies fed 5 minutes daily on clean monkey 2552 | – | |
| July 13 and following days | 51 | Flies allowed to die. Not dissected as experiment negative | | |

These experiments show that antelope of the water-buck, reed-buck and bush-buck species, when infected with the virus of sleeping sickness, can transmit the infection to clean laboratory-bred *G. palpalis*. The infected antelope's blood was, in one case, infective to *G. palpalis* for at least 81 days, and in another for at least 55 days. These experiments further show that the flies, when infected by the virus of sleeping sickness obtained from the blood of infected antelope, are capable of transmitting the virus to susceptible animals.

### (3) If Glossina palpalis can be Infected with the Virus of Sleeping Sickness by Feeding on the Blood of Trypanosoma gambiense infected Antelope, what Percentage are found to be so Infected?

It has been shown now that antelope can be infected with the virus of sleeping sickness, that when so infected they can infect the fly, and the fly in its turn can convey the disease to susceptible animals.

These facts form a serious sequence of events, which constitute a danger not formerly appreciated in the administrative measures adopted to check the spread of the disease. What is the extent of the danger? A part of this large and important query can be answered

if one can give an idea of the percentage of *G. palpalis* that become infected with the virus of sleeping sickness after they have fed on the infected antelope.

Throughout all these experiments only clean laboratory-bred flies were employed. The fact that there is no hereditary transmission of trypanosomes in *G. palpalis* is considered to have been so conclusively proved that two of the members of the Commission have allowed several hundreds of clean laboratory-bred flies to bite them. Further no evidence has ever been obtained by the Commission that these flies became infected with any flagellate by contact with other flies or fouled cages. Thus, any flagellates found in the laboratory-bred *G. palpalis* in these experiments must be considered to be derived from the infected antelope.

such naturally infected fowls and not from the antelope. Though many experiments were devised and carried out to try and confirm this one positive result, all efforts to infect fowls with sleeping sickness were so uniformly negative that the Commission must consider the one "positive" result to be an error.

A reference to Table III. will show that *G. palpalis* were infected by antelope blood where no fowls were ever fed on; in fact, it will be noticed that a higher percentage of negative results were obtained where fowls were introduced into the experiments. In some of the experiments the flies were dissected as they died throughout the whole experiment, and in others the flies were dissected only when the experiment became positive. If the experiment was a negative one the flies were not dissected. In order to avoid

TABLE III.—GIVING THE PERCENTAGE OF FLIES WHICH BECAME INFECTED WHEN FED ON INFECTED ANTELOPE. FLIES FED AT FIRST ON THE INFECTED ANTELOPE AND AFTERWARDS ONLY ON HEALTHY MONKEYS.

| No. of experiment | Species of antelope flies fed on | No. of flies used | No. of flies dissected | No. of infected flies found | Percentage of infected flies | Remarks |
|---|---|---|---|---|---|---|
| 2346 .. | Bush-buck 2328 .. | 160 | 122 | 21 | 17·2 | The gut contents of 6 infected flies injected into a rat gave it sleeping sickness. |
| 2384 .. | ,, 2328 .. | 100 | 91 | 10 | 11·0 | No injection of infected flies. |
| 2414 .. | ,, 2328 .. | 70 | 70 | 9 | 12·8 | Five infected flies injected into a rat gave it sleeping sickness. |
| 2501 .. | ,, 2328 .. | 100 | 57 | 12 | 21·0 | No injection of infected flies. |
| 2351 .. | Reed-buck 2357 .. | 100 | 84 | 9 | 10·7 | ,, ,, ,, |
| 2507 .. | ,, 2359 .. | 200 | 80 | 2 | 2·5 | ,, ,, ,, |
| 2477 .. | Bush-buck 2371 .. | 60 | 47 | 4 | 8·5 | ,, ,, ,, |
| 2478 .. | Water-buck 2378 .. | 60 | — | | -- | Negative experiment. Flies not dissected. |
| 2559 .. | ,, 2378 .. | 60 | — | — | -- | ,, ,, ,, |
| 2454 .. | Reed-buck 2427 .. | 110 | 92 | 13 | 14·2 | One infected fly injected into a rat gave it sleeping sickness. |
| 2485 .. | Bush-buck 2428 .. | 50 | 26 | 3 | 11·5 | No injection of infected flies. |
| 2460 .. | Reed-buck 2429 .. | 50 | 38 | 5 | 13·1 | ,, ,, ,, |
| 2543 .. | ,, 2429 .. | 100 | — | -- | — | Negative experiment. Flies not dissected. |
| 2544 .. | ,, 2431 .. | 90 | 53 | 5 | 16·6 | No injection of infected flies. |
| 2592 .. | ,, 2431 .. | 100 | 78 | 1 | 1·3 | ,, ,, ,, |
| 2476 .. | ,, 2445 .. | 50 | — | -- | — | Negative experiment. Flies not dissected. |

*Remarks.*—Of these 16 experiments, 12 were positive and 4 negative. In the positive experiments 838 flies were dissected. Of these, 94 showed heavy intestinal infection with developmental forms of *T. gambiense*, viz., 11·2 per cent. Of these infected flies, 43 were males and 51 females. If to these 838 flies be added all the *G. palpalis* of the negative experiments, we get a total of 1,108 flies, and a percentage of 8·5 infected. In only 3 of the positive experiments was an injection made into susceptible animals of the citrated gut-contents of the infected flies. All three gave positive results.

In some of the experiments the flies were fed, for varying periods, upon fowls. As will be shown in a further paper, the Commission found an avian trypanosome in some of the fowls obtained for experimental purposes. It would, therefore, be a fair criticism to state that a percentage of the flagellates found on dissection of the *Glossina* were avian in origin, were it not for the fact that negative experiments went to prove that this fowl trypanosome did not develop in the *Glossina*. It is also true that on one occasion the Commission thought they had succeeded in infecting a fowl with *T. gambiense;* it may, therefore, be argued that the fowls fed upon in some of these experiments were naturally infected with *T. gambiense*, and that the *Glossina* obtained their infection from

over-estimations of the percentage of infected flies, no fly was called infected unless its gut was *swarming* with trypanosomes, and all the flies dissected during the earlier days of the experiments have been included. No fly was found to be infected with trypanosomes before the nineteenth day after its first infected feed on a buck. The tables otherwise explain themselves.

The methods of procedure adopted in the experiments detailed in the following table were precisely the same as those of Table III., with this one exception: The flies were, for varying periods, fed upon fowls as well as upon monkeys.

An analysis of Tables III. and IV. brings out the following interesting points:—

In Experiment 2501, Table III., it is seen that 21 per cent. of the *G. palpalis* were infected, out of the 57 flies that survived for dissection on the 47th day of the experiment. These flies were infected by bush-buck, Experiment 2328, which had never shown *T. gambiense* in its blood; and fifty-five days had elapsed since any infected *Glossina* had fed on this buck.

Sixteen out of the twenty-four experiments were positive. If all the *G. palpalis* dissected in these positive experiments be grouped together, it is seen that a total of 1,102 flies were examined. Of these, 119 flies—54 male and 65 female — were infected with developmental forms of *T. gambiense* — that is, 10·8 flies in every hundred became infected, the sexes being about equally implicated. The highest percentage of infected flies in any one of the positive experiments was 21 per cent., in Experiment 2501, and the lowest was 1·3 per cent., in Experiment 2592. If to the total of 1,102 flies dissected in the positive experiments be added *all* the *Glossina* used in *all* the negative experiments, we get a total of 1,722 flies employed, and 6·9 flies in every hundred infected.

It is perhaps worth noting that a diet for the fly of antelope, fowl, and monkey blood gave a higher percentage of *negative* results and a lower percentage of flies infected than a diet of antelope and monkey blood only. This was quite unexpected, for the Commission, as a result of many experiments and considerable experience, were of the opinion that fowl's blood assisted the development of *T. gambiense* in *G. palpalis*.

TABLE IV.—GIVING THE PERCENTAGE OF FLIES WHICH BECAME INFECTED WHEN FED ON INFECTED ANTELOPE. FLIES FED AT FIRST ON THE INFECTED ANTELOPE AND AFTERWARDS ON FOWLS, BEFORE BEING FED ON HEALTHY MONKEYS.

| No. of experiment | Species of antelope flies fed on | No. of flies used | No. of flies dissected | No. of infected flies found | Percentage of infected flies | Remarks |
|---|---|---|---|---|---|---|
| 2500 .. | Reed-buck 2357 .. | 100 | — | — | — | Negative experiment. Flies not dissected |
| 2510 .. | ,, 2357 .. | 100 | — | — | — | ,, ,, |
| 2421 .. | Bush-buck 2371 .. | 50 | — | — | — | ,, ,, |
| 2499 .. | ,, 2372 .. | 100 | — | — | — | ,, ,, |
| 2451 .. | Water-buck 2378 .. | 95 | 93 | 2 | 2·1 | No injection of infected flies |
| 2456 .. | Reed-buck 2427 .. | 60 | 50 | 9 | 18·0 | ,, ,, |
| 2508 .. | ,, 2427 .. | 100 | 68 | 6 | 8·8 | Three infected flies injected into a rat gave it sleeping sickness |
| 2464 .. | ,, 2431 .. | 55 | 53 | 8 | 15·0 | No injection of infected flies |

*Remarks.*—It will be seen that when the flies were fed on fowls and monkeys in these eight experiments, four were positive and four negative. In the positive experiments 264 flies survived for dissection: of these 25 showed heavy intestinal infection with developmental forms of *T. gambiense*, *i.e.*, 9·47 per cent. Of the infected flies 11 were males and 14 females. If to these 264 flies be added all the *G. palpalis* of the four negative experiments, we get a total of 614 flies and a percentage of 4·0 infected. In the only experiment where an injection was made into a susceptible animal of the pooled citrated gut-contents of infected flies, the result was positive.

### (4) How does Sleeping Sickness affect the Health of Antelope?

This point is of considerable importance. If the disease killed the antelope within a short time of infection, or even if it seriously affected their health so as to render them incapable or unwilling to move about freely, the facts detailed above would lose some part of their practical value.

The word "health" is not used here in a technical sense—that is to say, the health was not estimated by a series of blood-counts and temperature charts. Interesting as such observations would have been, the Commission regret they were too short-handed and too much pressed by other work to carry them out.

Careful observations were made daily to answer the following questions: Did the infected antelope during the time they were under observation appear sick? Did they become emaciated? Was there loss of health and strength? Were there corneal opacities, œdematous swellings, conjunctival discharges, or staring coats? These questions may at once be answered in the negative, except in the case of reed-buck 2445, which will be referred to later below.

When the antelope were brought to the laboratory by the native hunters they invariably suffered from exhaustion, due probably to a combination of causes, such as fright, confinement for two to four days in cages too small to allow free movement, insufficient water and food, and the rough usage undergone when being caught. As a result of these unfavourable conditions, each antelope was kept under observation for a week or two before any experiments were undertaken. During this time they were well fed and comfortably housed in reed kraals erected in a fly-proof house. Some of the antelope, especially the "oribi" and "entalaganya," died during the first fortnight. The eleven survivors were the subjects of these experiments.

Nine of these buck were kept under daily observation for four months after becoming infected with *T. gambiense*. They remained apparently in perfect health.

The remaining two antelope were reed-buck. One, Experiment 2429, lived, and appeared very healthy, for ninety-three days after its infection. It then accidentally broke its leg and had to be killed. A *post-mortem* examination was made, and no evidence of trypanosomiasis was found. The other buck,

Experiment 2445, arrived at the laboratory in a poor state of health, and died twelve days after its infection. There was no sign of trypanosomiasis at the *post-mortem* examination.

It is therefore evident that antelope infected with the virus of sleeping sickness may live in apparently perfect health for at least four months, and this though they be kept under conditions less favourable than would occur in Nature, the constant handling and fly feedings to which these buck were subject being borne in mind.

### (5) Are Antelope Living in the Fly-area Naturally Infected with Sleeping Sickness?

Positive evidence on the last query would complete the chain of evidence that antelope living in the fly-areas may act as a reservoir of the virus of sleeping sickness. So far, it has only been proved that they are "potential" hosts.

The only method by which this query can be investigated is by capturing game in the fly-area, and then—

(1) Injecting their blood into animals susceptible to *T. gambiense* infection.

(2) Feeding cages of clean laboratory-bred *G. palpalis* on the newly killed buck, and subsequently endeavouring to infect animals susceptible to *T. gambiense* with these flies. (The Commission know by observation that *G. palpalis* will feed readily on animals newly killed.)

Those who know the local conditions will appreciate the difficulty of carrying out these methods of investigation. It would be necessary for large drives of the buck to be organized in the fly-areas. Several hundred natives would be required. Large numbers of clean laboratory-bred *Glossina* must be available, many normal susceptible animals must be in readiness, and, at the same time, be so situated that they cannot be bitten by the possibly infected wild flies in the neighbourhood. The laboratory work in hand may have to be abandoned for the time being, and some fifty to sixty buck must be captured or killed before reliable information is forthcoming. The sun is hot, the country very difficult, and the exposure to the bites of the fly very great.

It may be said at once that the Commission were only able to shoot two buck on the Lake-shore. The blood of these gave negative results for *T. gambiense* when injected into susceptible animals. One of them, however, gave a positive result for *T. vivax*. This trypanosome was proved by the Commission[1] to be not uncommonly carried by wild Lake-shore *G. palpalis*. It is therefore not unreasonable to suppose that at least one of the buck shot had been fed on by the Lake-shore fly.

It was recognized at length that occasional week-end shoots by a member of the Commission were quite inadequate. The assistance of the Acting-Governor f Uganda, S. C. Tomkins, Esq., C.M.G., the Acting Principal Medical Officer, Dr. C. Wiggins, of the Uganda Medical Staff, the Provincial Commissioners of Kampala, F. A. Knowles, Esq., C.M.G., and L. H. Cubitt, Esq., and of Sir Apolo Kagwa, K.C.M.G., the Prime Minister, was then sought to aid in organizing a series of large drives of wild game in the fly-area in the neighbourhood of the laboratory. We are greatly indebted to these gentlemen for their ready efforts on our behalf, which resulted in a large drive being organized. Unfortunately, the Commission were ordered to leave the country before the drive could take place. The work on these lines, however, is being continued by Dr. R. van Someren, of the Uganda Medical Staff, and Captain A. D. Fraser, Royal Army Medical Corps, who were instructed to take over the laboratory work.

This very difficult question, therefore, still awaits its answer.

[1] *Vide Roy. Soc. Proc.*, B, 1910, vol. 82, pp. 63 to 66.

### Conclusions.

(1) Water-buck, bush-buck, and reed-buck can readily be infected with a *human strain* of the trypanosome of sleeping sickness by the bites of infected *G. palpalis*.

(2) One exposure to the bites of infected flies is sufficient to infect an antelope with the virus of sleeping sickness.

(3) Though the blood of an antelope may be proved to be infected with *T. gambiense*, careful and continued examinations over prolonged periods may fail to reveal the presence of the parasite in the blood.

(4) The incubation of the disease (sleeping sickness) in antelope is probably seven days.

(5) Antelope of the water-buck, bush-buck, and reed-buck species, when infected with the virus of sleeping sickness, can transmit the infection to clean laboratory-bred *G. palpalis*.

(6) This transmission of the infection to clean laboratory-bred flies may occur at least eighty-one days after the last feed of the infected flies on a buck.

(7) *G. palpalis*, when infected with the virus of sleeping sickness obtained from the blood of infected antelope, are capable of transmitting the virus to susceptible animals.

(8) An appreciable percentage of *G. palpalis* will become infected with the virus of sleeping sickness should these flies feed on antelope suffering from this disease.

(9) It follows, from the above conclusions, that antelope living in the fly-areas are "potential" reservoirs of the virus of sleeping sickness.

(10) No antelope up to the present has been found naturally infected with *T. gambiense*.

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**"New York Medical Journal," February, 4, 1911.**

Baetz reports a case of American relapsing fever occurring at Ancon Hospital, Canal Zone, Panama. The case was that of a negro, aged twenty years, a native of Martinique. He had lived in Panama for two years. Ten days before admission to hospital he was taken ill suddenly with severe headache, pains in the back and epigastrium, vomiting, cramps in calves of legs, chills, fever, and sweating of about twenty-four hours' duration. The day following, though weak, he felt better, and remained so till the day of his admission into hospital, when he had a relapse with exactly similar symptoms. Five days after this he had a second relapse, and during the attack spirochætes were found in the blood, the true nature of the case thus being demonstrated—a third relapse terminated the complaint.

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THE JOURNAL OF

# Tropical Medicine and Hygiene

MARCH 1, 1911.


## "THE TREATMENT OF YAWS."

YAWS has points of similarity with syphilis, so much so that some observers have believed them to be the same disease. Though of the same nature in some ways, they are distinct and different diseases, the former being caused by the *Treponema pertenue*, the latter by the *T. pallidum*. Apes can be inoculated with both these organisms—the presence of the one not conferring immunity against the other—that is to say, a monkey suffering from yaws can be successfully inoculated with syphilis, and get the chancre and other lesions. With the two treponemata resembling each other morphologically so closely, it at once became interesting to see if salvarsan or "606," which had been so successful in syphilis, would be similarly so in yaws. Professor Ehrlich sent samples of his drugs to Castellani, in Ceylon, and to Strong, in Manila, and the results obtained by these two observers were dealt with fully in the last issue of the Journal. Castellani got quite good results in acute early cases, while his chronic old cases seemed much less amenable to treatment. Strong, on the other hand, seemed to be successful even in chronic cases, and the way the lesions in early cases cleared up led him to the belief that "606" would take its place as a specific against yaws in much the same way as quinine had done against malaria, or mercury against syphilis. Following on this work comes a paper by Alston, of Trinidad, in the *British Medical Journal* of February 18, 1911, on the curative effect of salvarsan on West Indian cases of frambœsia. Rost, a surgeon to a German cruiser visiting Trinidad, made the injections for him, three adults and two children being operated upon. Nine grains (0 6 grm.) in an emulsion with 5 to 6 c.c. of sterilized olive oil, was used for the adults, the injection being made deeply into the muscle of the buttocks In as short a period as twenty-four hours, a marked improvement was noticeable, the yaws tubercles drying up from the periphery, so that whitish circles appeared to be surrounding them. The improvement continuing, Alston, aware of Ehrlich's view that "606" created antibodies by rapidly destroying spirochætes, placed cantharides blisters on two of the cases being cured by the "606" treatment, and then injected the resulting serum into several untreated cases of yaws, the adult dose being 16 c.c. To his astonishment the serum acted as rapidly as the "606"; in some cases distinct improvement being noted as soon as sixteen hours after the injection. Further cases treated by injection of "606" again showed rapid improvement, and the serum obtained from these acted in a similar manner to that got from former cases. Control experiments, such as blistering healthy persons and injecting normal serum into yaws cases and blistering cases of yaws, and using their own serum for their injection gave negative results. Heating the serum from cases that were being cured, after "606" injections, did not alter its curative effect in any way, and Alston therefore abandoned his provisional hypothesis of fixation of the complement by the toxin.

During the experimental work, no other treatment of any kind was used, even baths not being permitted; so any fallacies in the work arising from that can therefore be eliminated. The next point of interest as regards the "606" treatment of yaws must necessarily be as to the nature of the permanency of the cure. So far, one injection only has been the routine treatment employed. With this, one of Castellani's cases relapsed in a month.

Strong believes that in a few of the most severe instances of the disease, where the ulcerations are extensive and of long standing, a second inoculation given about three weeks after the first may be advisable, and Alston now in his paper states that cases will require a second injection. The latter, however, does not state why he considers a second injection necessary, and the making of such a statement would seem to show that the drug had not been so efficacious as he had at first believed, or that relapses had taken place. It is too early yet to say with any degree of definiteness what the ultimate result of the "606" treatment will be, but there is evidently a great future for it if subsequent results are as good as those published up to date. Up till the present time the treatment of yaws has been a peculiarly hopeless one, the disease running a protracted course, with drugs influencing the symptoms and lesions but little. Mercury, one would have thought, should have done good, but though a specific for the treponema of

syphilis, it has always proved useless for that of yaws, and some have even thought that its administration instead of doing good did harm. Potassium iodide on the other hand would appear to be useful in yaws as well as syphilis, though to nothing like so great an extent in the former as in the latter. If then—with the treatment of a disease so abundant in parts of the Tropics in such an unsatisfactory position—a new drug of undoubted efficacy has been discovered, then all interested in tropical medicine must heartily rejoice. With the evidence before one there is evidently little doubt about the matter. To conclude then, it would seem that a new era has dawned for the treatment of yaws, a troublesome and mutilating disease which has in the past caused untold misery and suffering and which has practically defied all therapeutical methods.

## Abstract.

### THE DISCUSSION ON THE DISTRIBUTION AND PREVALENCE OF YELLOW FEVER IN WEST AFRICA AT THE SOCIETY OF TROPICAL MEDICINE AND HYGIENE.

*(Concluded.)*

Dr. Herbert E. Durham said that he must express surprise that Sir Rubert Boyce's proposition had been called new. He was under the impression that the state of affairs the latter described was well known ten years ago, and he thought it regrettable that active measures had not yet been undertaken. As regards factors contributing to the endemicity of yellow fever, except for the presence of typical cases of the disease we had no criterion of its existence, the germ not being recognizable, and we had no method of sero-diagnosis or other clinical test. For typical cases one had to rely on the chance infection of some unfortunate newcomer. He gathered from the late Major Reed that he (Reed) was inclined to lay considerable stress on the longevity of the infected mosquito, together with the importation of newcomers, as the chief means of keeping the fever alive. He (Dr. Durham) thought that more than this was necessary to ensure a constant supply of actively-infected mosquitoes. If it were granted that the advent of newcomers and primary attacks in children of residents or natives were insufficient, we had other possibilities: (1) The persistence of the virus in man after a single infection; and (2) through successive inoculations of one and the same individual (so-called immune). On the whole, the evidence was against a persistence of the virus in the blood of one individual after a single infection; the lesson from Havana was distinctly in this direction, but it should be remembered that a sort of commensalism, such as was seen in some other diseases, was not an impossibility. The reinfection of so-called immunes was, he believed, an important factor in the establishment of endemicity, but here much was bound up with the question of immunity, its meaning and extent. As regards immunity he thought that much darkness appeared still to prevail in our conceptions of the attribute of infective disorders, which, in Nature, never approached near the degree of comparative absolutism that could be obtained in laboratories. It used to be stated, and he had no doubt was still stated in text-books, that each specific fever gave protection against other attacks. This was generally true if we adhered to the old conception of a fever simply as a clinical picture, but that conception had, or ought to have, passed away, and given place to the supreme criterion of the presence of the essential factor—the *causa morbi vera*. Experiments had shown that there was no relationship between the amounts of antitoxic and of microbicidal matters that were engendered in the system during an infection. He took it that in yellow fever the antitoxic was the more prominently developed, and hence the microbe could live or multiply in the system of a so-called immune sufficiently to serve to infect mosquitoes, though its normal poison was largely, if not completely, annulled, whether by antitoxic destruction or by acquired toxin tolerance. Hence an immune might show but slight fever, and his kidneys and liver might well-nigh escape altogether. The protection given by a single attack of yellow fever was well known to be finite; so far as he was able to make out from records, it lasted about four years, that was to say, absence from an endemic area for about that time rendered a person liable to a typical attack on re-exposure. That meant, surely, that permanent residents must be constantly renewing and adding to their degree of immunity, inasmuch as they, proverbially, escaped further typical attacks. In his report from Para he gave special instances of severe and light cases, which were probably of the nature of yellow fever in immunes, and he might add that slight febrile attacks, both in children and adults, were quite common in the city, which was apparently free from malarial infection except at its outskirts.

Bilious remittent fever, that was to say, the febre remittente biliosa or dos paizes quentes of the Brazilian, Dr. Durham thought needed but few words—the few cases which he saw diagnosed in Pará showed no distinct points of difference from yellow fever, nor could he get a satisfactory reason for the diagnosis from the physician in charge. In Rio de Janeiro the yellow fever and the bilious remittent fever seasons coincided, and the distribution of yellow fever within the city bounds mapped out the distribution of remittente biliosa. In a word, he believed the two diseases existed hand to hand and whatever other fevers might be included under the term bilious remittent, it appeared obvious that one manifestation of yellow fever gave the clinical features of that disease. In epidemics children played a part. In a similar way they had been shown to be important carriers of malaria, just as they were of scarlet fever, measles and other epidemic complaints. He believed they were of considerable importance in spreading yellow fever, but careful attention would have to be paid to this point as the disease had a totally different clinical picture in them to that in adults. In addition to human cases a plentiful supply of suitable mosquitoes for propagating the germs were required. Summing up, he urged the need of paying minute attention to every slight case of

fever or indisposition, whether in an immune or a non-immune; the importance of recognizing the fever in the form in which children show it; the need of effective destruction of stegomyia mosquitoes; and of research into the true nature of the bilious remittent fever which occurs in yellow-fever countries.

Sir Patrick Manson said he had not seen cases of yellow fever; but had seen cases of bilious remittent fever, and indeed had suffered from it himself in China, in which country there was no suspicion of yellow fever ever having been present. If bilious remittent fever could occur then in a non-endemic area, its occurrence in an endemic area of yellow fever was no proof that it was yellow fever.

By Sir Rubert Boyce's term endemic he understood that what was meant was that yellow fever occurred in all the principal towns of West Africa, that practically it was universal there. With this view of universal endemicity he distinctly disagreed. Sir Rubert Boyce based his conclusions on a hypothesis and not on an established fact, that yellow fever is particularly mild in children, that children becoming infected acquire immunity from attacks of serious yellow fever, and that the immunity is maintained by a reinoculation, according to Dr. Durham, of four years. This was also the hypothesis of Simond and Marchoux, but after all it only was a hypothesis, and to think to contemplate serious action on the assumed correctness of an unproved hypothesis was a most dangerous proceeding. More than once serious errors had been committed by acting on an unproved hypothesis—cholera for example—and until this hypothesis under discussion was proved up to the hilt, he deprecated anything like popularizing the idea that it was a fact. He could suggest not one hypothesis only, but several, which to his mind, could explain the immunity of native races of which Professor Boyce made so important a basis for his argument. With reference to the attitude of those who held administrative posts, he should like to say that he had much sympathy with the responsible official. Sometimes medical men brought forward an erroneous though plausible idea which misled the official on the spot into acts for which he would be held responsible, and which might cost the country much before the error was detected. He was therefore chary in accepting all medical advice without an adequate proof of its soundness. Returning to Professor Boyce's hypothesis, if this theory was applied in practice, one official would act absolutely differently to another. Suppose, for example, that a responsible official in some West African town was approached on the subject of yellow fever and told that this disease was endemic in a neighbouring town and it was suggested to him that he should put on a quarantine against ships coming from that neighbouring town; he would say, "No, why punish my particular colony by putting on a quarantine against a disease which is always present in our midst, and from which the majority of my people are immune? One or two cases more or less will make no difference." These were some of the ideas, Sir Patrick said, which had occurred to him. He thought Professor Boyce had done the profession and the cause of public health an important service in bringing the subject forward so prominently, and undoubtedly this discussion and its publication would do a great deal to promote the consideration of the subject and the prevention of yellow fever in West Africa. At the same time, he would like to see a little caution observed before adopting and acting on purely hypothetical views as to the character, nature and cause of the endemicity of this disease.

Dr. J. W. W. Stephens said that he had studied the views put forward by Sir Rubert Boyce, and he was forced to the conclusion that the evidence clearly showed that yellow fever was endemic in West Africa. He thought, however, that a good deal depended upon what was meant by the word endemic. Some seemed to have expressed the view that endemic meant the prevalence of yellow fever in every large town in West Africa, and that cases should consequently be occurring in these towns. He thought, however, that there was another view of endemicity; that cases of yellow fever smouldered so to speak, perhaps widely scattered, and thus formed a different category of endemicity. We had in yellow fever no such objective test as we had in malaria with the spleen or blood examination, and until we got such tests we should not be able to show to what extent yellow fever was endemic in West Africa.

Dr. G. C. Walker said that he was at Cape Coast Castle in 1902, at the time of the outbreak there, and the cases he saw then were of just the same type as those he was later called upon to see by Dr. Ralph, at Sekondi, in May, 1910. With regard to the difference between yellow fever and bilious remittent fever, he was of the opinion that clinically they were as distinct from one another as scarlet fever was from small-pox. As to the endemicity of yellow fever in West Africa, one had to admit it was there much in the same way as small-pox was in England. Every one did not have yellow fever in West Africa, yet newcomers did get the disease. Where, he asked, did they get it from? In the outbreaks at which he had been present, he and others had tried to trace the source of the disease, but without success.

Dr. Prout said much depended upon what was meant by endemicity. If it was understood that yellow fever was endemic on the West Coast of Africa in the same sense as small-pox was, that is, that it existed at one or several spots, that it died out occasionally, broke out elsewhere, and so on, he had no hesitation whatever in accepting it; but if by endemicity was meant that at every spot, all the year round, wherever the Stegomyia was found, yellow fever existed in some form or other, generally quiescent, occasionally epidemic, he had to confess that so far as he had gone into the matter, Sir Rubert had not succeeded in convincing him, though he preserved an open mind. So far as his own personal experience went, he concluded that yellow fever did not exist in Sierra Leone during the time he was there. He agreed with Dr. Tulloch that there was a distinct clinical entity which might conveniently be described as bilious remittent fever and which was simply a form of that protean disease malaria. It was characterized by an irregular temperature, the presence of malignant tertian parasites in the peripheral circulation, though these might be rare and difficult to detect when quinine had been taken, marked gastro-hepatic symptoms, a variable degree of jaundice, absence of albumin in the urine, amenability

to the influence of quinine, and a pulse-rate which varied in proportion to the temperature.

So much did the last feature strike him that in lecturing to the students at Liverpool on the malignant fevers of the West Coast, he had pointed out, that with a little experience, one could tell the temperature from the pulse-rate—that particular fact had so impressed itself upon him that he could hardly believe that he had overlooked any marked departure from it. He did not deny that he had met with cases of high temperature with a slow pulse-rate, and cases which had been resistant to quinine, but these had been occasional, and other features had not been sufficient to justify a diagnosis of yellow fever. As regards reluctance in diagnosing yellow fever, speaking for himself—and he was sure the greater proportion of the staff would agree with him—he would not have had the slightest hesitation in drawing the attention of the executive to it, whatever their action subsequently might have been. On the whole, the evidence seemed to him to point to the introduction of yellow fever into definite localities, to its epidemic prevalence, and then to its disappearance, to re-appear in some neighbouring or distant spot, to which it might have been carried by the many and frequent means of transport which now existed.

Others having spoken, the President asked some questions, and then Sir Rubert Boyce replied to many of the issues raised. He said that he did not say that yellow fever was necessarily endemic in every village and town in West Africa, but that it was endemic in West Africa precisely as it was endemic in Venezuela, or along the Amazon; that was to say, that the disease was smouldering amongst the natives in very many centres, but not necessarily in all centres; precisely as in the case of diseases like cholera, which may be endemic in a country, but not necessarily present in every town or village.

## Helminthology.

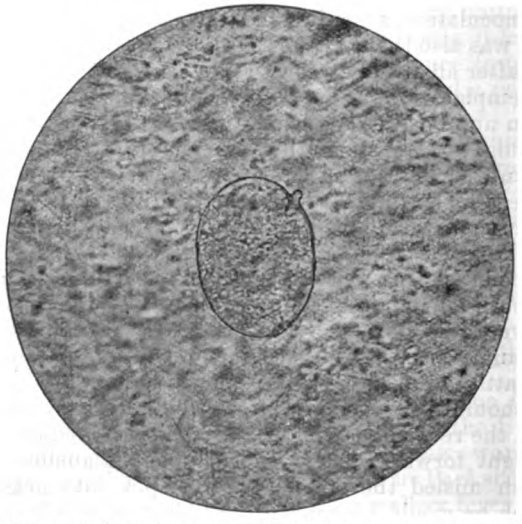
### NOTE ON THE PRESENCE OF A LATERAL SPINE IN THE EGGS OF *SCHISTOSOMA JAPONICUM*.[1]

Since the discovery of *Schistosoma japonicum* as a cause of bilharziasis in man in the Far East, by Katsurada and Catto in 1904, the various writers on the structure of the parasite and on the pathology of of this disease have been unanimous in emphasizing the *absence* of a spine in the egg of this species as a distinctive character.

Owing to the absence of special characters in the shell, the eggs were mistaken at first for coccidia, while Catto suggested that the close resemblance in size, shape and general appearance of the eggs to those of *Ancylostomum duodenale*, probably accounted for the fact that they had not been recognized previously in the course of the routine examination of stools by medical men in the East.

Recently, Dr. Skinner, of Hankow, sent to me for confirmatory examination a small quantity of fæces from a dog that had died of symptoms identical with those of advanced Asiatic bilharziasis in man. In the fæces and in scrapings of the intestinal wall, Dr. Skinner found a large number of ova apparently of *S. japonicum*, but at the *post-mortem* examination he had been unable to discover any adult worms in the portal system.

The material had been mixed with a little Farrant medium, and the eggs were fairly transparent. This enabled me to notice almost at first glance that although the eggs had the size, shape and general appearance of *S. japonicum*, there was present a curious little nipple-like knob or spine situated a short distance from one of the poles of each egg. Further search revealed the presence of a similar and similarly situated spine in all the eggs in the preparation. The questions then arose: (*a*) Is this spined egg characteristic of a new species of *Schistosomum?* or (*b*) is it an unobserved character of *S. japonicum* eggs? or (*c*) is it an instance of abnormal development in the eggs of *S. japonicum*, similar to the lateral spined egg that, Professor Looss maintains, occurs under certain circumstances in *S. hæmatobium?*



*Schistosomum japonicum* egg, showing lateral spine. × 250.

An examination of Catto's original specimens, of part of the material upon which Dr. Tsuchiya, of Tokio, based his monograph of *S. japonicum*, and of portions of intestine from two other human cases, from China, presented through Dr. Sandwith and Dr. Daniels to the London School of Tropical Medicine, has enabled me to confirm the presence of a spine in four cases of *S. japonicum* in man.

In some instances the spine at first appeared to be absent, but by careful rolling of the egg under the cover glass, the spine was ultimately brought into view in all these cases, so that as the result of an examination about fifty eggs from seven different cases, four from man and three from dogs, I have come to the conclusion that the schistosome found in the dog is of the same species as that found in man, and that the *S. japonicum* egg is characterized normally by the presence of a small knob-like cuticular spine.

[1] From the *Transactions of the Society of Tropical Medicine and Hygiene.*

In many of the ova the spine appears to rise from the centre of a slight navel-like depression in the egg-shell. The base of attachment is thickened in all, and spreads out upon the shell for a short distance somewhat similar to the attachment of a thorn to the stem of a rose.

This small observation seems worthy of record, not only on account of the importance of the ova of helminths found in the fæces in the diagnosis of the disease, but also because of the suggestive light it throws upon the value as a specific character of the lateral spine sometimes found in the eggs from cases of African bilharziasis upon which there has recently been such a warm controversy.

## NOTE ON THE NATIVE TRADITION THAT THE "GUINEA-WORM" CAN ATTAIN MATURITY OUTSIDE THE BODY.

The belief that the Guinea-worm can attain its full maturity outside the body is, although *a priori* exceedingly improbable, widely held by the natives in West Africa and is frequently vouched for by European settlers there. Joubert, Davaine and Blanchard sympathetically admit the tradition to their writings, and Bartet in the most recent monograph on Dracontiasis not only quotes Joubert's arguments at length, but definitely states his opinion that the matter is one meriting future investigation.

A short time ago Dr. Burrows, of the West African Medical Staff, kindly sent to me a large white round worm that, to naked-eye appearances, seemed to me to be a fairly well-grown Guinea-worm and as such I provisionally diagnosed it before opening the tube in which it arrived. On turning to the letter accompanying the consignment, I learnt that the supposed Guinea worm was one of those occasionally found in earth by the natives and regarded by them as the mature Guinea-worm.

An examination of the specimen with the microscope enabled me to ascertain that the worm was in reality a species of the genus *Mermis*, a group of nematodes in which the earlier period of life is passed in the body of some insect, but the terminal and sexual phase is attained during a brief free-living period.

Native traditions frequently contain some modicum of truth. In this instance the verisimilitude of truth is only dispelled by microscopical investigation.

Robert T. Leiper, M.B., F.Z.S.,
*Helminthologist to the London School of Tropical Medicine.*

**The "Sleeping Sickness Bulletin," February 15, 1911 (vol. iii., No. 24)**

Contains the following items: (1) the transmission of trypanosomes, (2) auto-agglutination, (3) the human trypanosome in vertebrate blood; (4) enumerative studies of sleeping sickness; (5) treatment of trypanosome infections; (6) antelopes as a sleeping sickness reservoir; (7) a case of cured human trypanosomiasis, autopsy; (8) the differentiation of trypanosome species; (9) the genus *Glossina*, new species; (10) acclimatization of *Trypanosoma lewisii*, and other papers; (11) sleeping sickness news; annotations, and monthly list of references.

# Notes and News.

At a recent meeting of the Liverpool School of Tropical Medicine an offer of the services of an experienced commissioner who would proceed to Manchuria to assist in combating the outbreak of plague was made to the Chinese Government. The Chinese Minister, in replying to the School's offer, thanked them, but said the question was under urgent consideration with the British Government who would associate themselves with the measures to be taken.

The British South Africa Company propose to send a special commissioner to Rhodesia, for the purpose of investigating the recent outbreak of sleeping sickness in that territory. The commission is to consist of Dr. Aylmer May, Principal Medical Officer of Northern Rhodesia; Dr. A. Kinghorn, of the Liverpool School of Tropical Medicine; Mr. H. Leach, of the Northern Rhodesian Medical Service; Mr. O. Silverlock, Entomologist; and Mr. Jollyman, Bacteriologist. The commission will study the question of the absence of *Glossina palpalis* in the Luangwa Valley, and will also inquire into points of peculiarity about the Rhodesian cases of sleeping sickness.

The *Indian Public Health and Municipal Journal* for January, 1911, announces new anti-malaria measures in Bengal. Our contemporary states that the "Lieutenant-Governor in Council with the approval of the Government of India, and with the consent of the gentlemen named below, has decided to appoint a Provincial Malaria Committee in Bengal, which shall comprise the following members: The Member of the Executive Council of the Government of Bengal in the Municipal (Medical) Department, President; the Secretary to the Local Government in the Public Works Department (Roads and Buildings Branch), the Secretary to the Local Government in the Public Works Department (Irrigation Branch), and Major L. Rogers, I.M.S., M.D.Lond., F.R.C.S. Eng., Professor of Pathology, Medical College, Calcutta, members; Assistant Surgeon Upendra Nath Brahmachari, M.A., M.D., Ph.D.(Calcutta), Teacher of Medicine, Campbell Medical School, Calcutta, and Dr. Nil Ratan Sircar, M.A., M.D. (Calcutta), members; the Sanitary Commissioner, Bengal, member and Secretary."

"Questions relating to the prevention of malaria frequently present problems which have both a medical and an engineering aspect, and expert knowledge in either branches will be represented upon the Committee thus constituted."

"The superior staff which will be placed, for the time being, at the disposal of the Committee will comprise one Deputy Sanitary Commissioner and one Assistant Surgeon. These officers will work under the direction of the Committee, whose duty it will be, subject to the control of the Local Government, to supervise the direction and method of the enquiries to be undertaken, to scrutinize the results ascertained from time to time, and to assist with their advice all action taken to cope with the problem of malaria in

Bengal. In other administrative matters connected with the subject, such as the distribution of quinine, the Committee will be consulted by the Local Government as occasion may arise, while the Sanitary Board will be directed to seek their assistance in the consideration of the bearing upon the question of malaria prevention of any drainage projects which may be brought before them. A delegate from the Provincial Committee will attend annually at the Central Conference which the Government of India will convene."

## Annotations.

*The Use of Salvarsan.*—In the *Journal of the American Medical Association* for February 4, 1911, Schamberg and Ginsburg, following the most recent advice from authoritative sources as well as their own experience of the use of salvarsan, give the following contra-indications and warnings for its safe employment:—

"(1) Don't use salvarsan in myocarditis, in advanced cases of tabes dorsalis and general paresis, in nerve syphilis affecting vital centres, in grave kidney disease, in cachectic and debilitated persons (unless the condition is due to syphilis), in aneurysm, in optic neuritis, and in persons with lesions (such as gastric ulcer) in whom increased blood-pressure may produce hæmorrhage.

"(2) Don't use intravenous injections of salvarsan until you have fully qualified yourself and possess a detailed knowledge of the technique. Deaths have occurred and more will occur from unskilful administration.

"(3) In the preparation of the drug for intravenous use, do not use a solution made with common salt or undistilled water (such as is often supplied in hospitals), but use a specially prepared sterile physiologic salt solution made with chemically-pure sodium chloride; otherwise you may find it impossible to obtain a clear solution.

"(4) Don't under any circumstance inject into the veins a solution which is not *perfectly clear;* a flocculent or cloudy liquid may produce alarming symptoms of collapse or even death.

"(5) Don't use a solution any more alkaline than is absolutely necessary to secure a clear solution.

"(6) Don't inject the salvarsan into the veins without previously running in physiological salt solution; if the needle is not in the vein you will infiltrate the surrounding tissue with the salvarsan solution and cause subsequent inflammation and unnecessary pain.

"(7) Don't infuse the solution into the vein too rapidly; it is best to have a needle of such a calibre as will require eight minutes to introduce 200 c.c. of fluid. With the gravity apparatus, the rapidity of inflow can also be governed by the height of the receptacle.

"(8) Don't infuse a cold solution; the liquid should be about the temperature of the blood.

"(9) Don't use 'glass pearls' in the mixing jar as is often recommended; we have found that minute particles of glass chip off which might cause embolism.

"(10) Don't use a routine dosage of the drug; the dose should be gauged according to the weight of the patient and the character of the condition to be treated.

"(11) Don't employ intravenous injections in your office or in a dispensary. The patient should be treated in a hospital and put to bed and carefully observed for a period of not less than three days.

"(12) Don't persist in the intravenous injection if the patient should show signs of collapse during the administration, but stop at once."

*Capsule Staining of Bacteria.*—Rosenow, in the *Journal of the American Medical Association* (February 11, 1911), describes a new method for staining bacterial capsules, especially the pneumococcus. His method is as follows:—

"Make a thin smear on a perfectly clean slide or cover-glass. If the material, such as sputum, is too thick, add enough distilled water so that it can be spread evenly by means of a piece of fine tissue or cigarette paper. In case of cultures (blood-agar, serum, glucose, or Loeffler's blood-serum being preferable), remove a small amount of the growth from the surface of the medium and at once mix thoroughly with a loopful of serum on the slide, or better still, make a rather dense suspension in a few drops of distilled water and then mix an equal quantity of this suspension with serum, and spread by means of tissue paper. As the smear becomes nearly dry cover for ten to twenty seconds with 5 to 10 per cent. aqueous solution of tannic acid; wash in water and blot; stain with carbol [saturated alcoholic solution gentian violet (Grübler) 1 part, 5 per cent. phenol in water, 4 parts] or aniline gentian violet, half a minute to a minute, heat over flame but do not boil; wash in water again; Gram's iodine solution for half a minute to a minute, decolorize in alcohol (95 per cent.); stain for from two to ten seconds, depending on the thickness of smears, with saturated alcoholic (60 per cent.) solution of Grübler's eosin; wash in water and blot finally, clear in xylol and mount in balsam, or examine directly. (If the organism, like the *Bacillus mucosus*, is Gram-negative, the bacillus may be stained with Loeffler's or aqueous methylene blue.)

The pneumococci are stained deeply brownish-black, sharply differentiated from the capsule, which is stained pink. Beautiful results are also obtained with the *Streptococcus mucosus*. In the thickest part of the smear the space occupied by the capsule may be perfectly clear; elsewhere in the smear, if properly made, where the conditions are suitable for absorption of eosin, the capsule is stained deeply pink; not rarely a clear retraction zone (often mistaken for the capsule in former methods) may be seen peripherally to a distinctly stained, often large capsule.

In case of sputum in which the cocci are embedded in a more or less tenacious mucus the capsules, at times, are not rendered stainable by the above method. In that case it is well to fix and stain simultaneously with the 2 per cent. aqueous tannic acid, 4 parts, and saturated solution of gentian violet, 1 part. This modification often gives beautiful results. The cocci, however, decolorize easily and the tannic acid-gentian-violet may be followed by carbol-gentian-violet

and then the usual procedure. Ordinary carbol-fuchsin, diluted five to ten times, and aqueous eosin (50 per cent. sat.) may also be used to stain the capsule, although the saturated alcoholic (60 per cent.) eosin has given the best results. Decolorization after the modified Gram procedure of tannic acid-fixed smears is more rapid than in the case of heat-fixed smears, which should be borne in mind."

*The Health of the Isthmian Canal.*—Colonel Gorgas, reporting on the health of the Isthmian Canal for December, 1910, states that the total number of deaths from all causes among employees was 44; from disease 32, from violence 12, giving the annual average per thousand of 10·91 for all causes. The annual average death-rate per thousand in the cities of Panama, Colon, and the Canal zone, including both employees and civil population, was 25·16. Amongst employees during the month, the deaths from the principal diseases were as follows: nephritis, 6; lobar pneumonia, 7; malarial fever, æstivo-autumnal, 2; hæmoglobinuric fever, 1; tuberculosis of the lungs, 4; organic disease of the heart, 2; leaving 10 deaths from all other diseases, and 12 deaths from external violence. No cases of yellow fever, small-pox, or plague originated on or were brought to the Isthmus during the month.

*Malarial Pigment.*—W. H. Brown, in the *Journal of Experimental Medicine* for February 1, 1911, writes on the nature and mode of production of malarial pigment. He describes two methods for the study of the pigment, the first of these being a method for obtaining a solution of malarial pigment from fixed tissues, without the removal of a trace of hæmoglobin from the red blood corpuscles, the second, a method for obtaining an iron reaction in malarial pigment. He believes that by comparing the bleach reactions and solubility of melanins and malarial pigment, a dissimilarity between the two classes of pigment can easily be demonstrated. Further, according to him, a spectroscopic examination of a solution of malarial pigment conclusively proves that the pigment is hæmatin. As regards the production of the pigment it is suggested that the action of a proteolytic enzyme of the malarial parasite upon the hæmoglobin of the red blood corpuscle is the most probable mode of the elaboration, and the difficulty with which the human organism disposes of malarial pigment indicates that the production of hæmatin cannot be considered as a normal intermediate process in the formation of bile pigments from hæmoglobin.

*The Treatment of Malaria.*—In the *British Medical Journal* of February 25, 1911, Lieut.-Colonel Bruce Skinner and Lieut. Carson, of the Royal Army Medical Corps, contribute a paper on the "Curative Influence of Röntgen Rays in Malaria." They thought it not unlikely that the blood changes which are known to be induced within the body after exposure to X-rays might stimulate the leucocytes to destroy the parasites, or that the altered serum would act in such a manner as to make the continued action of the parasites impossible. Considerable success seems to have followed their attempts by this method of treatment. Their experience leads them to the conclusion that the application of X-rays in cases of malarial fever relieves splenic pain and reduces recent engorgement; that the temperature falls and does not usually rise again; and that recovery is not attended by the anæmia usually present in cases treated with quinine. They had not to fall back upon quinine in cases treated by the X-rays, while on the other hand, cases which resisted quinine yielded promptly to the rays, even when the quinine was discontinued.

In cases of chronic malarial induration of the spleen, the progress made has not been sufficiently marked to enable the authors to make any definite statement as to the value of the rays in such cases. There are several points one would like to know before accepting these results. Do the parasites disappear from the blood after the application of the X-rays, no quinine having been given, or how long do the patients remain free from relapses after the exposure, again no quinine being given? Further, was the blood counted during the recovery after the exposure to the X-rays, as if not, how was it determined that there was not the anæmia usually present in cases treated with quinine?

## Personal Notes.

### India Office.

*Arrivals Reported in London.*—Major J. W. F. Rait, I.M.S., B.; Captain D. Munro, I.M.S., B.; Major A. Miller, I.M.S., M.; Lieutenant-Colonel W. A. Sykes, I.M.S., B.; Captain L. Reynolds, I.M.S.; Captain D. Heron, I.M.S.; Captain H. W. Pierpoint, I.M.S.

*Extensions of Leave.*—Major G. Lamb, I.M.S., B., 2 m., M.C.; Mr. E. P. Walsh, I.M.S., M. Cov., 4 m., M.C.; Captain V. B. Nesfield, I.M.S., to April 30; Captain G. A. Jolly, I.M.S., 2½ m.; Lieutenant-Colonel W. H. Quicke, I.M.S., Bo., 1 m., 7 d., M.C.; Major C. Donovan, I.M.S., 5 m., M.C.; Captain N. E. H. Scott, I.M.S., B., 14 d.; Major J. Mulvany, I.M.S., B., 3 m. 7 d.; Captain R. M. Carter, I.M.S., to July 26, 1912.

*Permitted to Return.*—Major P. Dee, I.M.S., B.; Lieutenant-Colonel H. P. Dimmock, I.M.S., Bo.

### List of Indian Military Officers on Leave.

*Showing the Name, Regiment, or Department, and the Period for which the Leave was granted.*

Sykes, Lieutenant-Colonel W. A., I.M.S.
Baker, Captain D. G. R. S., I.M.S., 1 yr., from December 13, 1910.
Donovan, Major C., I.M.S., 8 m., fr.
Heron, Captain D., I.M.S., to June 9, 1912.
Pierpoint, Captain H. W., I.M.S., 1 yr., from January 9, 1911.
Reynolds, Captain L., I.M.S.

### List of Indian Civil Officers on Leave (including Military Officers under Civil Rules).

*Showing the Name, Province, and Department, and the Period for and Date from which the Leave was granted.*

L. Said uz-Kafar Khan, I.S.M.D., U.P.
Miller, Major A., I.M.S.M., 18 m., December 19, 1910.
Munro, Captain D., I.M.S.B., 12 m., December 1, 1910.
Rait, Major J. W. F., I.M.S.B., 14 m., September 20, 1910.
S. Said uz-Kafar Khan, I.S.M.D., U.P.

### The Society of Tropical Medicine and Hygiene.

At a meeting of the Society of Tropical Medicine and Hygiene, held at 11, Chandos Street, Cavendish Square, London, W., on Friday, February 17, 1911, the following gentlemen were elected Fellows: D. A. Ashton, M.B., Lagos; G. Hamilton, L.R.C.P., Bordighera; H. McCormick Hanschell, M.R.C.S., London; Thomas Henderson, M.D., Florence, Italy; D. L. Hubbard, M.B., M.R.C.S., Bordighera; Evan Rhys Jones, M.R.C.S., Congo Belge; Angus Graham Macdonald, M.B., Jamaica; Lieutenant W. E. Marshall, R.A.M.C., Khartoum; Captain John Powell, R.A.M.C., Bahr el Ghazal; George C. Walker, M.D., Sanitary Officer, Accra.

## NOTICES.

THE AFRICAN ENTOMOLOGICAL RESEARCH COMMITTEE.

WITH a view to furthering the work of the African Entomological Research Committee, Mr. Andrew Carnegie has been good enough to place at its disposal a sum of £1,000 a year for three years to defray the cost of sending a few suitably-qualified young men to the United States to study the practical applications of entomology which have received so much attention in that country. Three of these Carnegie Scholars, as they are to be called, have been selected, and two of them are already at work in the States. The fact that Dr. L. O. Howard, Chief of the Bureau of Entomology at Washington, is personally interesting himself in the matter is a sufficient guarantee that all possible facilities will be given to the scholars, and it may be confidently expected that the scheme will be of great value to British administration in Africa and elsewhere by providing a body of well-trained entomologists available for employment in the services of the different Colonial Governments.

It may be mentioned that the Research Committee was appointed in June, 1909, by Lord Crewe, the then Secretary of State for the Colonies, with the object of promoting the study of the insects which play so prominent a part in the spread of disease among men, animals, and plants in Africa; that Lord Cromer is its President, and that it includes some of the most eminent authorities on entomology and tropical medicine in this country.

During the short period of the Committee's existence satisfactory progress has been made. The scheme has been energetically taken up by the African Colonies and Protectorates, and the large quantity of material already received at the Committee's Office in the Natural History Museum at South Kensington has very materially increased our knowledge of the insect pests of Africa. The collections of insects, after being properly identified and recorded, are being distributed to the Schools of Tropical Medicine, Universities, Museums, or other institutions where they are likely to be of value for the purpose of teaching or scientific study. Two skilled entomologists are being employed under the direction of the Committee in East and West Africa respectively, for the purpose of interesting and instructing the local officials in the work, and also of carrying out special investigations.

The Committee has issued quarterly a scientific journal, entitled the *Bulletin of Entomological Research*, of which the first volume is just completed. It contains many important articles by well-known authorities, and is obtaining a wide circulation. Further particulars may be obtained from the Secretary of the Committee—Mr. Guy Marshall, British Museum (Natural History), South Kensington, London.

## Recent and Current Literature.

*A list of recent publications and articles bearing on tropical diseases is given below. To readers interested in any branch of tropical literature mentioned in these lists the Editors of the* JOURNAL OF TROPICAL MEDICINE AND HYGIENE *will be pleased, when possible, to send, on application, the medical journals in which the articles appear.*

### "Medical Record," January 28, 1911.

Stokes writes on the surgical aspects of filariasis. His preliminary remarks on the species of filaria are by no means accurate, but his descriptions of the various clinical manifestations produced by the *Filaria bancrofti* are of a higher standard. The lesions he quotes are the following:—Varicose inguinal glands, lymph scrotum, chylocele, chyluria, and elephantiasis. He might also have mentioned filarial abscesses, filarial lymphangitis, and filarial nodosities. The different operations required for elephantiasis of the scrotum and elsewhere are given in detail.

### "Journal of the American Medical Association," January 28, 1911.

Gunn reports the occurrence of hook-worm disease in the mines of California. He states that from 50 to 80 per cent. of those working in these mines are infected, and that the infection undoubtedly is present in practically all of the gold mines of California and in those just over the border of Nevada. He believes that most of the mines of the country have been exposed to infection, for in nearly all of them may be found Hungarians, Austrians, Italians, or Cornish men, some of whom are certain to have brought the infection with them from the mines of their countries.

### "Journal of the Royal Army Medical Corps," No. 2, February, 1911. vol. xvi.

Captain R. G. Anderson, in his final report of the Sudan Sleeping Sickness Commission, 1908-1909, states that owing to the absence of evidence of human trypanosomiasis in the Southern Sudan and the consequent limitation of clinical and pathological investigations, he confined his observations more particularly to the habits and distribution of the tsetse flies throughout the region. Both *Glossina morsitans* and *G. palpalis* are found, though the natives do not differentiate between the two species, and have never heard of sleeping sickness. The presence of *G. palpalis* is a potential danger, however—a matter which Captain Anderson has dealt with in his Intermediate Report on Preventative and Administrative Measures.

### "British Medical Journal," January 28, 1911.

Williamson, referring to Professor Gallé's recent discovery of the Leishman-Donovan bodies in a case of ponos from Spetsai recalls his own suggestion, made in 1909, that ponos and infantile kala-azar were really the same disease. The clinical descriptions of ponos certainly suggested kala-azar to anyone knowing the latter disease, but why this infantile form, which is widely spread on the Mediterranean, should only, as far as is known, attack infants, whereas the kala-azar of the East is commonest in adults, is yet unknown.

## Notices to Correspondents.

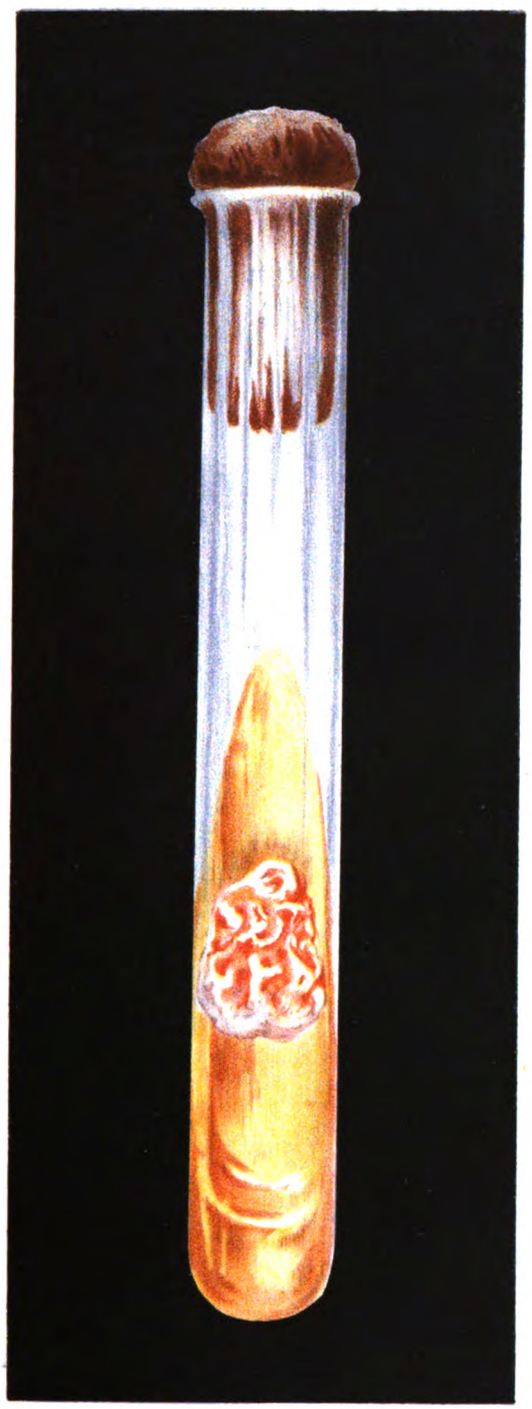
1.—Manuscripts sent in cannot be returned.

2.—As our contributors are for the most part resident abroad, proofs will not be submitted to those dwelling outside the United Kingdom, unless specially desired and arranged for.

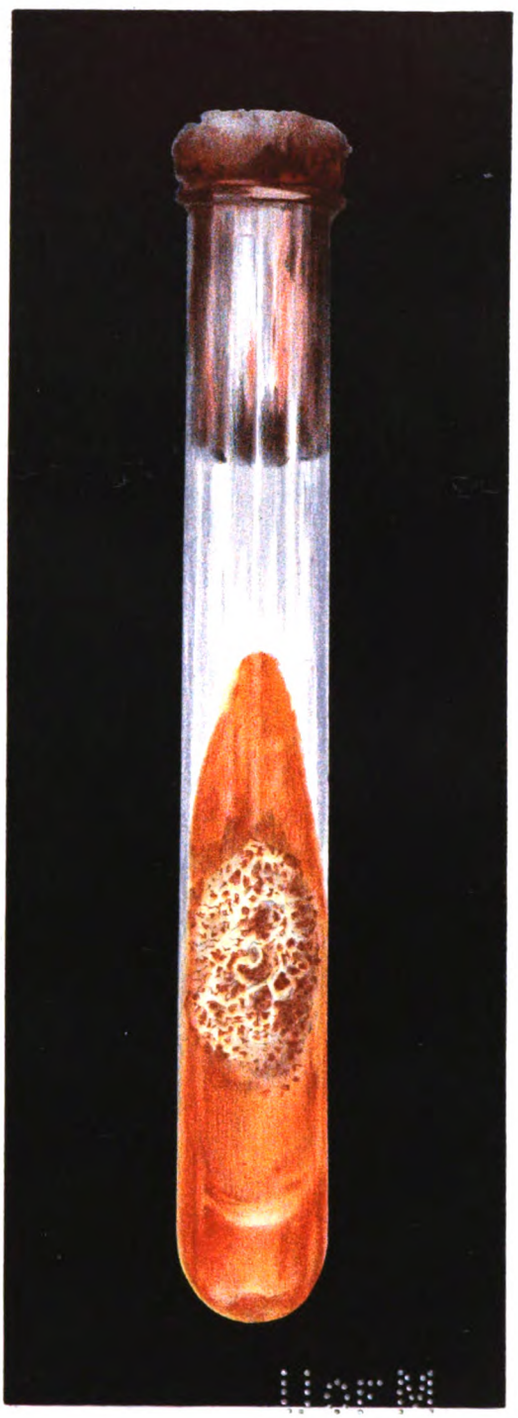
3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.

4.—Authors desiring reprints of their communications to the JOURNAL OF TROPICAL MEDICINE AND HYGIENE should communicate with the Publishers.

5.—Correspondents should look for replies under the heading "Answers to Correspondents."

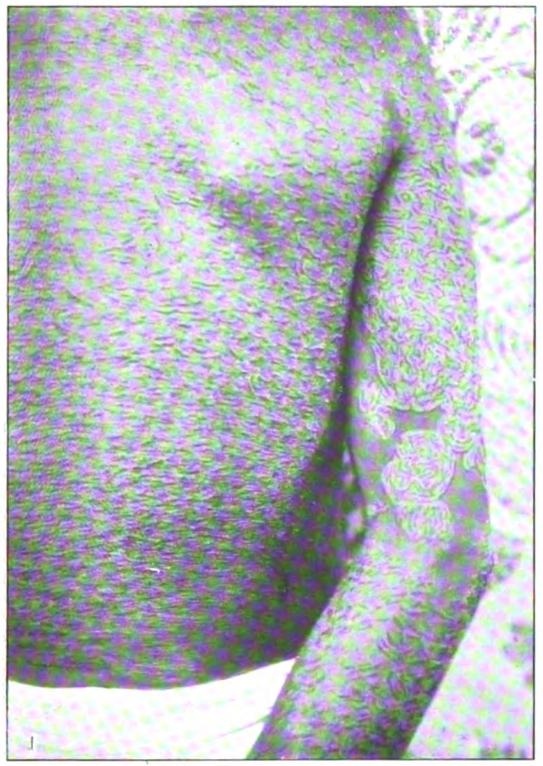


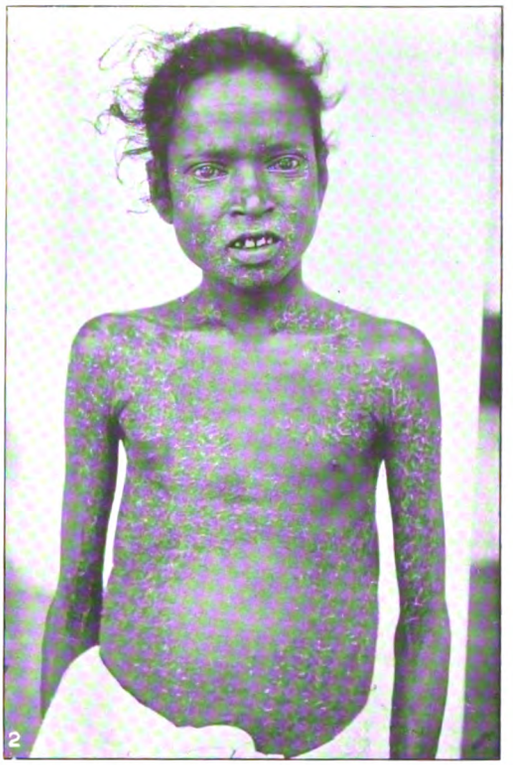
ENDODERMOPHYTON INDICUM.
(Culture on glucose-agar.)

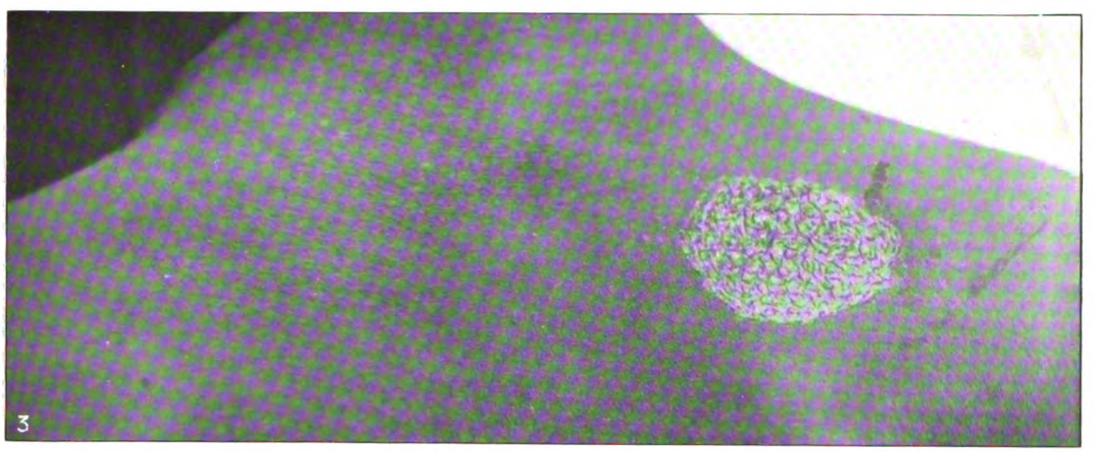


ENDODERMOPHYTON CONCENTRICUM.
(Culture on glucose-agar.)

To illustrate "Further Researches on the Hyphomycetes of Tinea imbricata," by ALDO CASTELLANI, M.D., *Director, Clinic for Tropical Diseases, Colombo (Ceylon).*







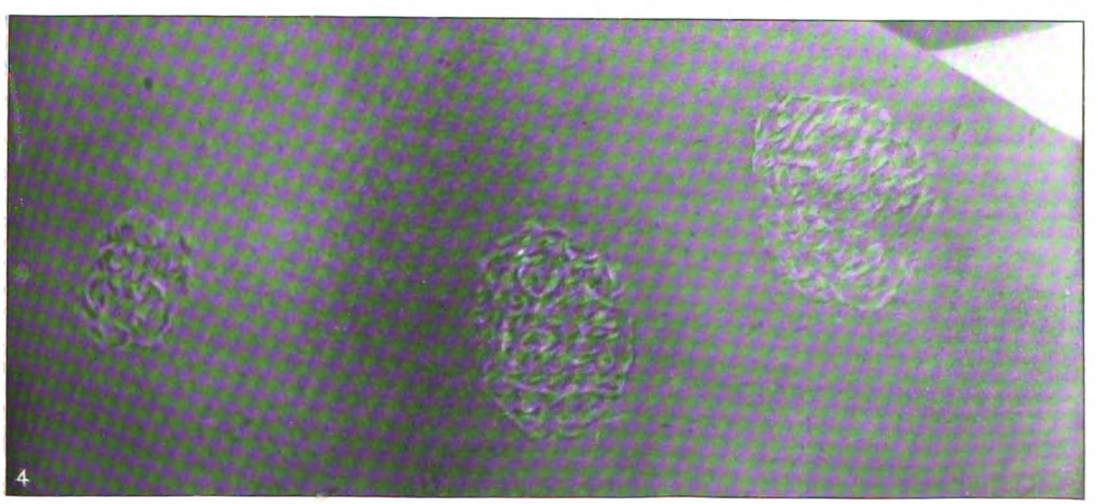


FIG. 1.- TINEA IMBRICATA. Case due to *Endodermophyton concentricum.*
FIG. 2.—TINEA IMBRICATA. Case due to *Endodermophyton indicum.*
FIG. 3.—EXPERIMENTAL TINEA IMBRICATA. Boy inoculated with a culture of *Endodermophyton concentricum,*
FIG. 4.—EXPERIMENTAL TINEA IMBRICATA. Boy inoculated with a culture of *Endodermophyton indicum.*

To illustrate "Further Researches on the Hyphomycetes of Tinea Imbricata," by ALDO CASTELLANI, M.D.

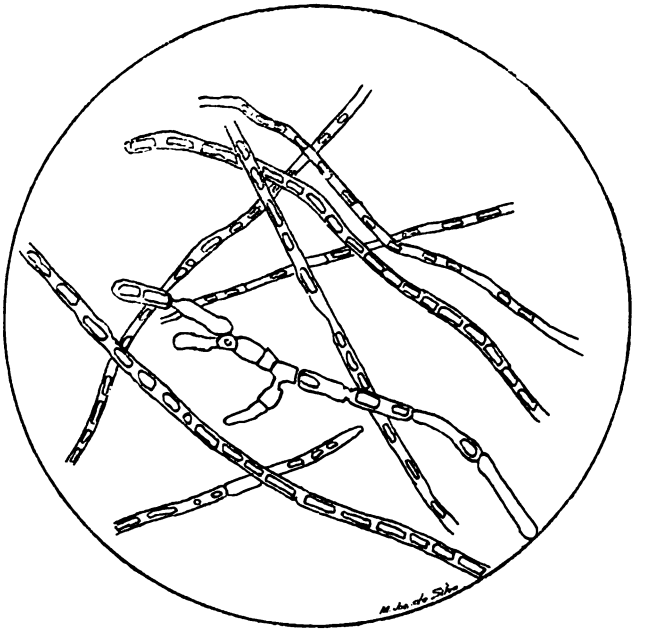
## Original Communications.

# FURTHER RESEARCHES ON THE HYPHOMYCETES OF TINEA IMBRICATA.

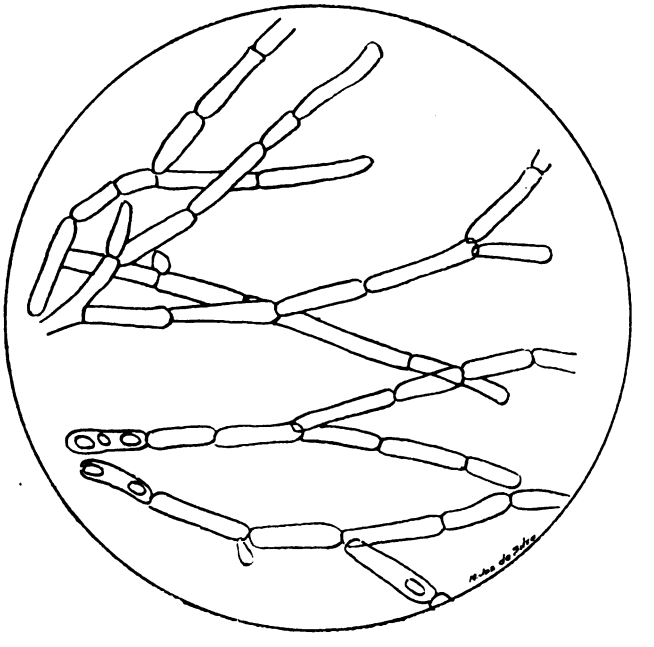
By Aldo Castellani, M.D.

*Director, Clinic for Tropical Diseases, Colombo (Ceylon).*

In a previous paper I gave the results of an investigation I carried out on the cultivation of the fungus of tinea imbricata. I stated that the fungus can be grown on artificial media, and that by inoculating a pure culture of it I succeeded in experimentally producing the disease in a human being. I also stated that possibly in analogy to what is found in tinea cruris and tinea corporis, the malady may be caused by different species of fungi. According to my further researches carried out in three more cases, there would seem to be little doubt as to the plurality of species of the fungus. In Ceylon at least two species are found; one corresponds to strains 1 and 2, described in my previous paper, and for which the term, *Endodermophyton concentricum* (Blanchard) might be maintained. For the other species, to be presently described, I suggest the name of *E. indicum*; this has been isolated from two of the three new cases, but strain 4 of my first paper may possibly be identical to it. As regards strain 3 of my first publication, no further investigation has been made.



*Endodermophyton indicum* (hanging-drop culture).



*Endodermophyton concentricum* (hanging-drop culture).

### Endodermophyton concentricum: Microscopical and Cultural Characters.

The characters of this species correspond, on the whole, to those given in my previous article for strains 1 and 2, but it may be of advantage, perhaps, to give here a brief general description of the species, embodying the results of the investigation of a third strain of the same species found in one of the new cases.

Preparations in liq. potass. from scales show a felt of interlacing mycelial tubes; the segments are rather regular in shape, somewhat square-shaped, and usually straight. If the liq. potass. be left to act some time, the mycelial articles which are of very variable length, and $2\frac{1}{2}$ to $3\frac{1}{2}\mu$ in breadth, will be seen to have a double contour. Aspergillus-like fructifications are always absent in my experience. Fresh preparations from young cultures show abundant septate mycelium, with rather long, straight articles; in old cultures the shape of the mycelial tubes may be irregular. In hanging-drop cultures (Sabouraud's broth) long mycelial septate threads are seen, no free spores. Reproduction apparently is by sprouts from the mycelium, branching taking place.

*The cultural characters on solid media when the growth is fifteen to twenty-one days old* are as follows:—

*Glucose agar* (4 per cent.)—Growth abundant, surface cerebriform or crinkled. The growth and the medium show a slight amber colour which later on may become of much deeper hue. No duvet.

*Sabouraud-agar.* — Growth comparatively scanty, whitish-grey, mostly submerged. The colonies have generally a small central knob, and never show any duvet. The submerged portion is very firmly imbedded, and presents projections deepening in the medium; colour of the medium unchanged.

*Mannite-agar* (4 per cent.).—Appearance somewhat similar to glucose, but growth less abundant. The medium may take a slight amber colour. No duvet.

*Saccharose-agar* (4 per cent.). — Growth rather scanty, similar to Sabouraud. Duvet absent.

*Glycerine-agar* (4 per cent.).—Similar to Sabouraud; when the colonies coalesce, the growth shows a knobby surface. No duvet.

*Nutrose-agar* (4 per cent.).—Slow growth, separate young colonies have a central knob; when they coalesce, a knobby mass is formed.

*Agar.*—Scanty growth, somewhat similar to Sabouraud. No duvet.

*Maltose-agar* (acid).—Similar to Sabouraud.

*Maltose-agar* (alkaline).—Similar to Sabouraud.

*Adonite-agar.* — Not very abundant, cerebriform. Duvet absent.

*Galactose-agar.*—Knobby or cerebriform.

*Levulose-agar.*—Knobby.

*Raffinose-agar.*—Cerebriform.

*Inuline-agar.*—Cerebriform.

*Saccharine-agar.* (4 per cent.).—Somewhat knobby surface. Duvet absent.

*Lactose-agar.*—Similar to Sabouraud; but surface-growth more abundant.

*Gelatine.*—Very slow liquefaction of the medium.

*Milk.*—Very scanty growth, after a time the medium becomes separated.

*Sugar Broths.*—(Maltose, lactose, &c.), slight growth at the bottom of the tube, no production of acid or gas.

ENDODERMOPHYTON INDICUM, N. S.P., MICROSCOPICAL AND CULTURAL CHARACTERS:—

The microscopical appearance of this fungus is to all purposes identical to that of *Endodermophyton concentricum.* The cultural characters on solid media when the growth is between fifteen and twenty-one days old, are as follows:

*Glucose-agar* (4 per cent.)—Growth fairly abundant, with surface somewhat convoluted or furrowed—portion of the growth, often the central, is of a deep orange or pinkish-orange, or reddish-orange colour. The surface of the rest of the growth appears white and powdery, being covered by a very short delicate duvet.

*Sabouraud-agar.*—Slow growth, white powdered surface either with central knob or furrowed. The growth does not deepen in the medium so much as *Endodermophyton concentricum.*

*Mannite-agar.* — Growth knobby or convoluted, covered by white short duvet.

*Saccharose-agar.*—Cerebriform, covered by white duvet.

*Saccharine.*—Crinkled surface; delicate white duvet present.

*Maltose-agar* (acid).—Somewhat similar to Sabouraud, but the surface-growth is more abundant.

*Maltose-agar* (alkaline).—Similar to acid maltose but the white duvet is more abundant.

*Lactose-agar.*—Knobby surface covered by snow-white duvet.

*Glycerine-agar.*—Growth abundant, yellowish or amber colour, delicate white, short duvet present on some portions of the growth.

*Nutrose-agar.*—Yellowish surface, crinkled; short white duvet present.

*Agar.*—Growth fairly abundant, knobby surface covered by snow-white, very short, delicate duvet.

*Levulose-agar.*—Scanty growth, yellow or orange, scarce, very short-white duvet present.

*Galactose-agar.*—Fairly abundant, surface convoluted with abundant short snow-white duvet.

*Raffinose-agar.*—Same appearance as galactose.

*Inuline-agar.*—Same appearance as in galactose and raffinose agars.

*Adonite-agar.*—Cerebriform, surface covered with snow-white duvet.

*Gelatine.*—Very slow liquefaction.

*Lit. Milk.*—Very scanty growth (after a time the medium may become separated).

*Various Sugar Broths.*—(Maltose, lactose, &c.). Slight growth at the bottom of the tube. No production of acid or gas.

COMPARISON BETWEEN THE CULTURAL CHARACTERS OF ENDODERMOPHYTON CONCENTRICUM AND OF ENDODERMOPHYTON INDICUM.

The annexed Table shows at a glance the different cultural characteristics of the two fungi in the principal media.

TABLE SHOWING THE PRINCIPAL CULTURAL CHARACTERS OF ENDODERMOPHYTON CONCENTRICUM AND ENDODERMOPHYTON INDICUM.

| Media | *E. concentricum* | *E. indicum* |
|---|---|---|
| Glucose-agar .. | Amber colour; duvet absent | Deep orange, with occasionally pinkish hue; white, very short delicate duvet present |
| Sabouraud-agar | Growth scanty; mostly submerged. grey-whitish; duvet absent | Surface growth more abundant; powdery white |
| Agar .. .. | Scanty, mostly submerged; similar to Sabouraud-agar; no duvet | Fairly abundant; knobby; well marked snow-white duvet |
| Glycerine-agar | Growth mostly submerged; surface growth very scanty; similar to Sabouraud-agar; no duvet | Surface growth very abundant; crinkled appearance; white, short duvet present |

*Experimental Tinea Imbricata, by Inoculation of Cultures of Endodermophyton concentricum and Endodermophyton indicum.*—The successful production of tinea imbricata in a human being by inoculation of a pure culture of *Endodermophyton concentricum* (strain 1) was mentioned in my first paper. A Sinhalese boy—Abraham—whose skin was perfectly normal, developed after two weeks two small patches of tinea imbricata at the three spots of inoculation. These patches have gradually enlarged and are now (January, 1911) so extremely itchy that the patient being unwilling to continue the experiment, I have decided to treat them[1]. From the scales of the patches the *Endodermophyton concentricum* has been grown, with the identical characters of the strain used for the inoculation of the boy.

More recently (November, 1910) I have inoculated a native, who voluntarily submitted himself to the operation, with a pure culture of *Endodermophyton indicum.* This native, a Sinhalese lad named Hinniappu, 17 years of age, had his skin free from

[1] The treatment of isolated patches is comparatively easy, but the difficulty of treating tinea imbricata when diffuse is well known; what in my hands has answered best is the method of treatment I introduced several years ago, viz., resorcin dissolved in tr. benzoini according to the formula—resorcin, 2 drachms, tr. benzoini, 1 oz.

eruptions of any kind. I scarified his skin with a sterile knife, drawing a little blood on five different spots: one on the right arm, one on the left arm, and three on the back. A certain amount of pure agar culture of *Endodermophyton indicum* was then well rubbed in.

After three weeks from inoculation small roundish patches of tinea imbricata developed at four out of the five places at which he had been inoculated. The patches have gradually increased in size and are at the present time very pruriginous. The scales of all the patches examined microscopically in liq. potass. show a large amount of mycelium, and on cultivation a fungus has been grown absolutely identical to the strain of *Endodermophyton indicum* with which the boy was inoculated.

*Conclusions.*

(1) The hyphomycetes of tinea imbricata can be grown on artificial media.

(2) It would seem from my researches that there is a plurality of species of fungi producing the disease.

(3) In Ceylon at least two different species can be differentiated: *Endodermophyton*[1] *concentricum* (Blanchard) and *Endodermophyton indicum*, n. sp.

(4) The disease can be experimentally reproduced in human beings by inoculating cultures either of *Endodermophyton concentricum* or of *Endodermophyton indicum*.

(5) It is possible that the further investigation of tinea imbricata may show that to different species of fungi correspond slightly different clinical varieties of tinea imbricata. I have had the impression that the lesions produced by *Endodermophyton indicum* are somewhat less severe and slightly more superficial than those induced by *Endodermophyton concentricum*, but, of course, much further investigation is required to clear this point.

## THE ETIOLOGY OF ELEPHANTIASIS.[2]

By GEORGE C. LOW, M.A., M.D.

A DIVERSITY of opinion still exists as to the part the *Filaria bancrofti* plays in the production of tropical elephantiasis. Personally, I have not the slightest doubt that the filaria mentioned is the prime cause of the trouble. The explanation or definite proof of this is, however, by no means an easy matter because of several things: (1) Many people, as I have shown in my statistics of the West Indian Islands, may exhibit embryos in their blood, thus clearly indicating that they are infected, and yet exhibit no symptoms of any disease. As to how long this immunity from attack may last can only be accurately gauged by following up the histories of the cases in detail. Many certainly go on for years without suffering from any disease, and if this is so, then others may be still more fortunate and escape altogether. On the other hand, many undoubtedly do eventually get pathological lesions, and ultimately develop elephantiasis as the following examples show. When in St. Vincent, West Indies, in October, 1901, in my general examination of the population for filariasis, I found filarial embryos (*F. bancrofti*) in the blood of two of the native nurses at the Colonial Hospital, although they presented no signs of any filarial disease. In 1908, *i.e.*, seven years later, I happened to meet Dr. Branch, of St. Vincent, in London one day, and during our conversation he mentioned that both these nurses had developed elephantiasis. Again, when in St. Vincent, I saw a case of elephantiasis in an old negro, with no embryo filaria in his blood; Dr. Newsam, however, told me that Sir Patrick, then Dr. Manson, had found embryos in the same individual's blood in 1894, seven years before. (These were found in blood films sent by Dr. Newsam to Sir Patrick Manson in London). (2) After early pathological lesions appear (*F. lymphangitis*, for example), it is the common thing—at least in the condition mentioned—for embryos to disappear from the peripheral blood. A large series of cases specially examined for this purpose by me has always shown this to be the case. Though the explanation of this is not difficult, yet some can never see how it should be and therefore at once, when they are told that embryos are absent, begin to doubt that the filaria has anything to do with the causation of the lesion. (3) In the late sequels of the disease (elephantiasis), the same thing (no embryos in blood) holds good, and further, cases of elephantiasis are found in places where there are no filariæ, so the sceptic at once exclaims, "How can the filaria have anything to do with elephantiasis?" Such argument of course, is based on an incomplete and faulty knowledge of the whole subject and cannot be taken seriously. The late lesions of filariasis may, for explanatory purposes, be likened to the late ones produced by the gonococcus. In a stricture of the urethra, occurring years after an attack of gonorrhœa, one does not expect to find the gonococcus; the cause has long gone, but the result remains. So it is with elephantiasis, occurring years after an infection with *F. bancrofti*: the cause—the filaria—has gone, but the result—the damages produced to the lymphatics—remains. Again, all strictures are not due to antecedent gonorrhœa—a small percentage, 5 per cent. say, may be due to trauma and other causes; just in the same way *all* cases of elephantiasis are not necessarily due to the filaria—a small percentage, 5 per cent. say, or lower, may be due to prevertebral fibrosis, or tumours pressing on the thoracic duct and so on. The proof of the pudding lies in the fact, that where filariasis is common, elephantiasis is common; where filariasis is rare, elephantiasis is rare; where filariasis is absent, elephantiasis is absent, or at most is represented by a spurious case from time to time due to chronic erysipelas, tumours, or some other cause than the filaria. Lastly, if filarial lymphangitis is admitted to be due to the *F. bancrofti*, then elephantiasis must also be admitted, because one can trace the former step by step by insensible grades into the latter.

[1] The genus *Endodermophyton* was established by me in 1909 to denote the hyphomycetes of tinea imbricata and tinea intersecta, which are characterized by their growing between the superficial and deep strata of the epidermis, forming an interlacing felt of mycelium which detaches the horny and granular layers from the rete malphighi: they do not invade the hair follicles and do not cause suppuration.

[2] Part of a thesis on Human Filariasis for the degree of M.D. Edinburgh.

Elephantiasis of filarial origin may attack any part of the body, the legs and scrotum being most commonly affected. The arms, scalp, penis, vulva and mammæ do not entirely escape however, and pedunculated masses may even grow out from the groins. Practically all anthorities are agreed that tropical elephantiasis follows repeated attacks of filarial lymphangitis (elephantoid fever or fever and ague). Manson, for example, states in his text-book on "Tropical Disease," p. 585, that "the disease (elephantiasis) commences with a rapidly-evolved lymphangitis, dermatitis, and cellulitis, accompanied by elephantoid fever. Occasionally, though very rarely, enlargement may progress after one, two, or more initial inflammatory attacks, and without recurrence of these." Daniels also has reported similar cases to these latter ones where the elephantiasis developed without special disturbance and without fever. Wilson, in Fiji, in a report on "Elephantiasis and Filariasis," published locally and for the perusal of which I am indebted to the courtesy of Dr. Corney, late Principal Medical Officer of Fiji, states: "In all the cases of elephantiasis a clear and definite history of recurrent attacks of elephantoid fever was given," and again: "Elephantoid fever is, in my experience, an essential condition in the production of true elephantiasis, and it occurs sooner or later in a large majority of cases of varicose groin glands. Daniels refers to cases of elephantiasis without any pain or febrile attacks; these I imagine to be very rare and may possibly correspond with the cases of elephantiasis occurring in non-filarial countries."

My experiences are similar; in the vast majority of cases the usual history is for the patient to have suffered previously with attacks of filarial lymphangitis, a little permanent thickening remaining after each, till a stage is reached when one calls the condition elephantiasis. There is no necessity to record such cases, therefore, but those rarer ones, quoted by Daniels and Manson, where the disease goes on after a single attack, or after none at all, without pain, are of extreme interest. Wilson, apparently, never saw such cases in Fiji, but I was more fortunate in the West Indies as I find I have records of four such cases. The histories of these are as follows:—

(1) Case 2.—Filarial Diseases: Barbados, Series B.

*Elephantiasis Left Foot and Leg.*

Medford, aged 22, female, mulatto.

*History.*—An attack of fever and ague (the Barbadian name for elephantoid fever or filarial lymphangitis), at 13, left leg; no subsequent attacks. Is absolutely certain of this. When 20, instep began to swell, no special pain and no febrile attacks. Six months afterwards leg began to swell and case developed into an ordinary one of elephantiasis. Patient was quite certain about only having the one attack of lymphangitis, because, as she said, the pain and symptoms were so severe she could not possibly have forgotten any subsequent ones.

*State on Examination.*—Left leg and foot very big, typical elephantiasis. Dr. Brown, of Barbados, operated, taking large slices of the tissue out; the result was very satisfactory, there being quite a marked diminution of the swelling. The interest of the case lies in there having been only one attack of lymphangitis.

*Blood Examination.*—October 15, 1901, two large washed-out blood smears at night; 0.

(2) Case 12.—Filarial Diseases: Barbados, Series B.

*Elephantiasis both Legs.*

Sarah Willock, female, aged 70, negress. Born Demerara, residing in Barbados.

*History.*—Never had "fever and ague" (filarial lymphangitis). In her younger days always healthy and never any sign of inflammation or swelling of legs. Thirty-seven years ago, when 33 years of age, had twins. After this, legs began gradually to swell and a permanent thickening eventually became noticeable. The swelling always became worse when pregnant and after several pregnancies legs became definitely elephantoid. Swelling not associated with any special pain, and never any signs of inflammation. She is absolutely certain about never having had "fever or ague," has never had chyluria, nor varicose groin glands, nor any other visible signs of filarial disease. Within the last few years the swelling has diminished. No ulceration. Patient was admitted into hospital for double cataract and that was how she was seen. She made no complaint about her legs.

*State on Examination.*—Right side: Foot slightly elephantoid, well marked sulcus over ankle. Calf very large, thigh also swollen but not so much in proportion to calf. Left side: foot normal, calf thickened much less than right; thigh not thickened. No palpable glands in femoral or inguinal regions; no other filarial symptoms.

*Diagnosis.*—Typical elephantiasis.

*Blood Examination (night).*—October 21, 1901, one slide, 0; October 23, 1901, three large slides, 0.

*Further Notes.*—October 27, 1901. No change in legs, no signs of any inflammation. No temperature. Patient left hospital after operation on cataract and was not seen again. The case is a good example of elephantiasis developing without any previous lymphangitis or febrile attacks.

(3) Case 13.—Filarial Diseases: Barbados, Series B.

*Elephantiasis Right Foot and Leg.*

Julia Toppin, female, aged 30, mulatto. Born and lived in Barbados all her life.

*History.*—No previous illness; has always been specially healthy, never "fever and ague" or anything in the slightest degree approaching that condition. Came into hospital complaining of general weakness and swelling of right leg. Four months ago she felt as if she was not so strong as usual, and did not feel up to her work. Just about that time noticed right instep slightly swollen one day, and this, instead of going away, gradually became more marked, and the leg became stiff. The right foot next began to swell and then also the leg (chiefly the calf) below the knee; no pain, no inflammation, purely a painless swelling. With the swelling she

felt weak, somewhat out of sorts and became tired easily.

*State on Examination.*—Early stage of elephantiasis right foot and leg, an exactly similar appearance to that seen after repeated attacks of filarial lymphangitis, when some definite permanent thickening remains, and when one begins to talk of the condition as early elephantiasis. Sulcus over ankle nil—no ulceration or signs of any inflammation. Some pigmentation over dorsum of foot. No enlarged glands in groins or elsewhere, no other clinical filarial signs.

*Blood Examination (night).*—October 21, 1901, one slide, 0. October 23, 1901, three slides + two *Microfilaria bancrofti* found.

*Remarks.*—This is a very interesting case from many points of view. It shows the gradual onset of elephantiasis without any previous inflammatory changes, and, further, the very first stages of the disease, as the duration of the swelling was only four months. Again the blood examination on October 23, still showed scanty filarial embryos, which indicated most likely that the blockage of the lymphatics had not then reached a sufficient degree to prevent all ingress of embryos into the blood.

This idea was borne out by subsequent blood examinations during the following months, when embryos had completely disappeared from the peripheral blood, none ever being detected again after the date mentioned. One was certainly fortunate to get the case at this very interesting period—viz., the commencement of the elephantiasis and the disappearance of the embryonic filaria from the blood.

(4) Case 3.—Filarial Diseases: Barbados, Series B.

*Elephantiasis of Scrotum.*

The condition developing without any history of previous attacks of "fever and ague," but after that patient did suffer from them.

James Potter, male, aged 48, white. Born and lived in Barbados.

*History.*—In youth healthy, never suffered from "fever and ague"; twenty-four years ago scrotum began to swell and gradually to increase in size; attacks of lymphangitis then became frequent and often there was great pain in the left hip running down left leg. Until the scrotum was quite big and distinctly elephantoid, there had been no attacks of lymphangitis. He is absolutely certain of this. In 1883 operated on, a portion of the scrotum being taken away, after this the condition remained quiescent with few attacks of lymphangitis till 1900, when the scrotum began to grow again rapidly, increasing greatly in size. Operated on again October 10, 1901, growth almost completely removed. Lymphous blood-stained discharge for following days. No other signs of filarial disease elsewhere.

*Progress.*—October 18, 1901, wound still open, some of the stitches having given way. Very little discharge. October 23, 1901, wound healing gradually, temperature now normal.

*Examination of Lymph and Blood* discharging from scrotum, negative. No signs of filarial embryos, eggs or adult worms.

*Blood Examinations.*—(Night), October 15, 1901, two slides, 0. October 23, 1901, three slides, 0.

In addition to these, amongst a private series of cases which I saw through the kindness of the doctors in Barbados (Barbados, Series P.), occurred a painless swelling of the hand and forearm in a girl. It was not absolutely certain perhaps that this was elephantiasis, but the condition of the infected part showed solid œdema in no way different from ordinary elephantiasis, with the exception that the skin was much smoother than usually got in that complaint. This might easily be accounted for by the protection the part had always had, however, as the girl was of a good family, and had no need to use or unnecessarily expose the limb. The doctor I saw the case with thought the swelling was elephantoid, and I was inclined to agree with him.

The explanation of the pathology of such cases is by no means easy. How can one explain, for example, No. 3 of the series given? In the production of the vast majority of cases of elephantiasis, as already mentioned, preceding attacks of lymphangitis are the usual thing. The filariæ damage the lymphatics in some way or other, probably causing stenosis and blockage by setting up inflammatory changes, or in some instances perhaps by their aborting eggs, as suggested by Sir Patrick Manson. Given such damage to the lymphatics, the limb then appears to become specially subject to the invasion of micro-organisms and erysipelatous attacks succeed each other with varying degrees of frequency. The products of these inflammatory changes are removed with greater difficulty now than in a healthy limb, and this difficulty increases with each subsequent attack till permanent thickening remains. Exposure to the sun, rain and wind quickly help in making the skin hard, rough, and horny, and the typical picture of elephantiasis then appears. That other factors may produce a similar condition is evident, however, from the cases quoted above, and in these, at least, inflammation or inflammatory attacks did not seem to be necessary, or a predisposing factor. I cannot agree with Wilson's idea that this class of case may correspond to the elephantiasis occurring in non-filarial countries.

To begin with, some of these non-tropical cases—notably one I saw in London, who could not possibly have been infected with the filaria—get attacks of lymphangitis and fever very similar to the elephantiasis cases in the Tropics, and further, though the class of case mentioned—viz., those who have developed elephantiasis without febrile attacks or pain in the Tropics—are by no means common, yet one certainly sees more of them than one does of elephantiasis cases in England and other places, where the filaria as a factor in the production cannot possibly exist. Another, perhaps less potent argument is that they are absolutely identical with the cases that have developed after repeated attacks of inflammation; and in No. 3 of the series which I have given, the presence of the filaria with its gradual disappearance was conclusively demonstrated. I am quite convinced in my own mind that this class of case is due to the filaria primarily, just as in the

common cases, but, after that, how the condition is actually produced is not by any means easy to determine. In the ordinary cases of elephantiasis everyone is more or less satisfied that the filaria *per se* does not cause the condition; organisms apparently also help, and of these the streptococcus is the one most likely to assist. The absence of embryos from the blood in elephantiasis is easily explained by the pathological lesions found—the adults are long dead, and there are no embryos therefore to find their way into the blood. In heavily-infected countries it is quite feasible that such a case should get reinfected with filaria—the adults inhabiting some of the lymphatics in a different part of the body—and in that case embryos will again appear in the blood. I have noted this in several instances in St. Kitts, a heavily-infected area. *Post-mortem* examinations in many instances do not help one much as, if the case is one of long standing, age will have obliterated many of the characteristic changes that must have been present when the lesion started. Similarly, the dissection of elephantoid limbs, apart from showing the usual pathological lesions of thickening, hypertrophy, and solid œdema, do not reveal the etiology of the production of the condition.

I carefully dissected four elephantiasis legs removed by operation in the West Indies, but found nothing to account satisfactorily for the condition present. In leaving the pathology and etiology of elephantiasis and some of the other filarial manifestations then, one must admit that there are many points by no means clear or definitely settled. Extended work is required for the solution of the different problems presented.

**"New York Medical Journal," January 21, 1911.**

Harvey and Carey, of Troy, New York, record a rapidly fatal case of amœbiasis with abscess of the liver, originating in the village of Green Island, New York. They recall Paterson's views that amœbiasis is not a purely tropical disease, and that, though not common, it is endemic in New York. The case under discussion was operated on for the abscess in the liver, but died. At the autopsy an amœbic ulcer of the cæcum was found, and in the liver great necrosis with multiple abscesses. The authors could not trace the source of the infection.

**"The Journal of Experimental Medicine," February 1, 1911, (vol. xiii., No. 2).**

Mary Rowley-Lawson describes a sexual cycle of the æstivo-autumnal parasite in the circulating blood of man, and also gives a description of the morphological and biological characteristics of the parasite. She believes that her studies demonstrate that not only is there differentiation amongst the gametes (crescents) into male and female elements, but that the process of fertilization and sporulation occurs in the circulating blood of human beings. The macrogametes, after fertilization, again assume a crescentic form, reach the reproductive phase and undergo sporulation, the product of which appears to be the small ring-formed parasite again. This idea would therefore seem to differ from the parthenogenetic reproduction of gametes that has recently been described, and it is strange that if such a phenomenon occurs it has never been noticed before—the diagrams are by no means convincing, and the work manifestly requires confirmation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THE JOURNAL OF

# Tropical Medicine and Hygiene

MARCH 15, 1911.


## TROPICAL RESEARCH.

RECENTLY there has been a great activity in research work in the Tropics and sub-Tropics, and there is evidence to show that this activity is to go on increasing in the future. The two tropical schools of England, the Royal Society, the Government, and other bodies have been chiefly instrumental in the rapid onward march as far as this country is concerned, but America, France, Germany, and other foreign nations have also done yeoman service and are little, if at all, behind in the race. After all, all are working for the same object, namely, the object of benefiting humanity at large by ameliorating the lot of the inhabitants of the hotter parts of the globe, and everyone, at home or abroad, should lend their aid to join in any attempts to carry on such a laudable effort. The progress of the tropical schools of England, founded only some twelve years ago, has indeed been truly phenomenal, and the hold that the study of tropical medicine has taken upon the country generally is clearly indicated by the constant addition to the teaching staffs and building accommodations of the London and Liverpool Schools of Tropical Medicine. Both these institutions have done splendid research work, and have sent out numerous expeditions to different parts of the Tropics. Dr. Wenyon has just,

for example, returned to London from Asia Minor, where he has been conducting some extremely interesting research work on the etiology and modes of spread of Oriental sore. Dr. Bahr has been on an expedition, also for the London School of Tropical Medicine, to Fiji, where he has been studying dysentery and filariasis, and is now on his way home, while Drs. Fraser and Stanton at the Research Institute at Kuala Lumpur, Federated Malay States, an institution officered by London School of Tropical Medicine men, have done excellent work as regards the part that rice plays in the spread of beri-beri. It is no exaggeration to say that the following up of Dr. Braddon's original idea by these two men may in time save thousands and thousands of lives, and solve one of the greatest difficulties of that country—namely, the high death-rate amongst the native labourers employed upon the plantations. Liverpool has just sent out another expedition, under Dr. Todd, to West Africa, to study further points in the distribution and spread of sleeping sickness, and in addition to this are utilizing their tropical material at home for many valuable studies by the home staff, assisted by a young and active school of workers. Both schools have specialists on protozoology, helminthology and entomology on their staffs now, so that material sent home from abroad may be examined, diagnosed, catalogued and suitably stored by these experts, and afterwards be used for teaching purposes. The Royal Society has also done good service in sending commissions abroad to study different tropical diseases. Sir David Bruce and his colleagues have but recently returned from Uganda where they were engaged in the study of sleeping sickness, and many of their valuable papers have from time to time been published in different numbers of the Journal. Much of the future prophylaxis of sleeping sickness will depend on their extensive and valuable researches. The British South Africa Company propose to send an expedition at once to Rhodesia to study the sleeping sickness cases that have been recently occurring there apparently in the absence of the usual intermediate host *Glossina palpalis*. The spread of sleeping sickness to Nyasaland and Rhodesia is a serious menace to the people living there, and it is right that no stone should be left unturned in the attempt to get at the bottom of the matter. The work of the commission should furnish some of the most interesting material that has ever come to light on the etiology and spread of this deadly disease.

Nor must the British Government, the Foreign and Colonial offices, be passed over lightly in this brief summary. Without their constant aid, assistance and financial help it is not too much to say that half of this work could never have been accomplished. Always interested in every department and in every development of tropical medicine and the tropical schools, one of the most recent of their many valuable pieces of work was the foundation of the African Entomological Research Committee.

In our last issue of the Journal readers would note the very valuable help Mr. Andrew Carnegie had given to this Committee, by placing at their disposal a sum of £1,000 a year for three years to defray the cost of sending a few suitably-qualified young men to the United States to study the practical application of entomology, which has received so much attention in that country. Such generosity cannot be too highly commended, and if only other philanthropists would come forward to help in the battle against the diseases of the Tropics, like Mr. Carnegie has done, then all would be well. The tropical schools and incidentally the researches they carry on abroad cannot go on without funds, and that has really been the drag on much of the recent work. It is strange when so much money is given away to general hospitals, churches and other institutions, that no one thinks of the London School of Tropical Medicine, for example, and the splendid work it is doing and has done. It is to be hoped that in the future this may change and that money will pour into the coffers of institutions whose duties are to make the Tropics healthy, so that when the flower of our youth goes there they may remain in health and eventually return to Britain, instead of dying and leaving their bones in these inhospitable lands, like so many have done before them.

## Helminthology.

### (a) Original Investigations.

### ONCHOCERCIASIS IN CATTLE, WITH SPECIAL REFERENCE TO THE STRUCTURE AND BIONOMIC CHARACTERS OF THE PARASITE.[1]

The condition here termed Onchocerciasis is met with in frozen beef imported from Australia, in which are present nodules or tumours, variously known amongst butchers and veterinarians as "White Kernels," "Parasitic Nodules," "Worm Kernels," "Worm Nodules," "Worm Nests," "Parasitic Tumours," "Spiropteric Tumours," "Worm-nest Tumours." The material on which this report is based was obtained in the Port of London.

These nodules vary in size from that of a pea to that of a walnut, and are almost always found in the connective tissues. The seat of election is the brisket. They occur commonly also on the flank and forequarter. The nodules may also be found in the hindquarter in the region of the knee joint, and, where there is a heavy infection may occasionally be found embedded in the muscular tissue of other parts of the body.

Whatever the position of the nodule, its characters are essentially the same. In shape it is oval, to the touch firm and resilient; its surface is closely matted and smooth and it lies in a stroma of connective tissue from which, in the thawed-out condition, it can easily be excised, without rupture, if its presence is previously determined by palpation. Within the fibrous capsule of the nodule are always found one or more long threadlike worms, not unlike catgut in appearance, and inextricably coiled in a delicate meshwork of fibres.

[1] From Reports to the Local Government Board on Public Health and Medical Subjects. New Series, No. 45, Food Reports. No. 11.

A similar condition is well known in horses in southern Europe, and in man in tropical Africa.

In all cases the exciting cause of the nodule formation is essentially the same—viz., a round worm of the family of Filariidæ, and belonging to the genus *Onchocerca*.

### Historical.

Onchocerciasis in cattle was first observed and recorded in Australia by Dr. William Morris of Sydney in 1880. Later Dr. Gibson drew the attention of the Intercolonial Medical Congress of Australia (1892) to certain "worm nests" occurring in the cellular tissue of the brisket in cattle. Dr. Bancroft (1892), and Dr. Park (1893), noted its presence in beef in Queensland, whilst Mr. Stanley (1893) recorded it for New South Wales.

In 1907 Dr. J. Burton Cleland described "Spiroptera nodules," embedded in the muscles, as common in cattle in Western Australia.

These and other Australian writers appear to have regarded the parasite as quite peculiar to Australian beef. A study of the literature shows, however, that the condition may be considered to have a much wider distribution.

### Geographical Distribution.

Not only is this parasitic condition known to occur in cattle in Queensland, New South Wales, and Western Australia, but there are official records by Curtice and Stiles of its presence in the United States of America, by Daniels and Ford for the Malay States, by DeDoes for Java, and Lingard for India. The detection of the tumours has nearly always been made by veterinary officers in the course of their inspection of meat for human consumption.

### The Parasites.

When an unruptured nodule is carefully incised with a sharp knife to the depth of about a quarter of an inch and then prised open with the fingers, a number of small loops of what appear to be pieces of catgut spring up into the base of the incision. These are portions of the body of the female worm, and it is noticeable that to the naked eye they show a faint but regular transverse striation. Towards the centre of the nodule the male worm may be found by careful searching. This is recognized by its very slender form, its apparent lack of striation, and its loose attachment to the stroma of the nodule.

The anatomical characters usually presented by the worms which I have examined may now be described:—

#### *Anatomy of the Male Worm.*

The male worm is hair-like, and measures 1½ in. to 1¾ in. in length. At no part of the body is the skin raised into thick transverse ridges so characteristically present in the female. The body tapers very gradually towards both extremities from the middle third of the worm where the diameter is about 0·15 mm. The anterior portion is quite straight, but the posterior end is ventrally coiled. Except anteriorly, where the skin appears to be quite smooth, there are regular fine striæ crossing the cuticle at 0·045 mm. apart.

The mouth is a minute terminal pore without lips or observable papillæ. The œsophagus is long and slender. It is crossed by the nerve ring 0·2 mm. from the mouth, and attains a length of 0·8 mm. The posterior is distinguished from the anterior half by the presence in the former of transverse muscular fibrillæ. The diameter of the œsophagus gradually increases in size from 0·02 mm. at the level of the nerve ring to 0·05 mm. just before its inosculation with the chyle-intestine.

The chyle-intestine is a narrow tube of only 0·025 mm. diameter; it has a thin cellular wall and a wide lumen, and runs backwards to the ano-genital orifice near the posterior end of the body.

The ano-genital orifice is situated in the mid-ventral line 0·07 mm. from the tip of the tail. The body at this point measures 0·04 mm. in antero-posterior diameter. The lips of the pore are slightly protuberant. From here the testicular tube runs forwards alongside the chyle-intestine with only slight twists and without coiling, to within 0·73 mm. of the junction of chyle-intestine with œsophagus. At this point the testicular tube is only 0·02 mm in diameter. With a sudden twist it returns upon itself for a distance of about 0·38 mm. to end blindly in a slight globular swelling. At the middle of the worm the testicle has a diameter of 0·07 mm.

The spicules or copulatory organs, two in number, are of markedly dissimilar shape and size, and are almost always retracted within the body. Their general design follows closely that found in *O. volvulus*, a closely-allied parasite of man in Africa, and appears to be generic in character.

The large spicule measures 0·18 mm. in length, and is 0·005 mm. across. Its outline is slightly arcuate. The proximal extremity has a band-like thickening, the distal end is fluted. At the middle of this spicule there is an opening passing obliquely into the lumen of the distal portion. It resembles the eye of a catheter and may possibly function for the conveyance of spermatozoa from the end of the testicular tube.

The smaller spicule measures only 0·08 mm. in length and gradually tapers from a diameter of 0·005 mm. to 0·002 mm. at 0·001 mm. from the distal end. The terminal $\frac{1}{200}$ mm. of the spicule is dilated to form a pyriform knob, not unlike a dental burr. There is no accessory piece.

The papillæ, like the spicules, show certain characteristics that appear to be generic. As in other species of the genus *Onchocerca*, they are arranged in two groups—perianal and caudal. The perianal group consists of four pairs of small nipple-like papillæ, of which the foremost pair lies somewhat separated from the others, which are closely set together. The foremost pair is pre-anal, the others are post-anal.

The caudal group consists of two pairs, a somewhat large pair pointing ventrally at about 0·02 mm. from the extreme tip of the tail, and a smaller pair presenting backwards on each side of the posterior end. A narrow ledge of cuticle extends from the post-anal to the caudal papillæ on either side of the body, and is supported by them.

#### *Anatomy of the Female Worm.*

The female worm could only be examined in short lengths, owing to the extraordinary manner in which

she threads her body through the connective tissue stroma in the centre of the nodule.

No accurate estimate can be given of the entire length of the worm. In transverse measurement pieces apparently from about the middle of the body are 0·4 to 0·5 mm.

The anterior extremity tapers gradually to end in a blunt finger-like tip 0·1 mm. in diameter. Tiny papillæ can be seen around the mouth. The œsophagus measures 1 mm. in length and increases gradually in thickness from the mouth to its termination in the chyle-intestine, its greatest measurement being 0·03 mm.

The vulva lies in the mid-ventral line at 1·23 mm. from the mouth.

The vagina is a long tube with a very thick muscular wall. It maintains an almost uniform diameter of about 0·05 mm. In the specimens examined, there was an S-shaped twist upon the vagina at 0·3 mm. from the vulva. It was not possible to determine the length of the vagina, the fragment terminating where the vagina was 1 mm. from the valva. From other fragments the uterine tubes were found to have a diameter of 0·07 mm. Some portions of these uterine tubes contained ova at various stages of development, others contained well-developed embryos within egg shells. In other portions again fully-developed embryos alone occurred. The mature worm is apparently viviparous. The ova measure 0·04 mm. by 0·03 mm. The skin of the female is covered with a thick and rigid cuticle, so that when the parasite is cut across the body retains its contour and does not collapse. Along each side of the body the subcuticle is thickened as the lateral bands and in these areas large clear nuclei are found regularly arranged in linear rows.

The outer surface of the cuticle shows considerable variations in the extent of its markings in different parts of the female body. That part covering the worm in the region of the œsophagus shows no markings whatever. In the region of the vagina, simple transverse hoop-like bands project regularly from the surface, barely 0·008 mm. These encircle the dorsal and ventral surfaces of the worm, but disappear on either side, leaving a smooth area about 0·014 mm. across in the region of the lateral bands. Towards the middle of the body the transverse markings project considerably, and when seen in optical section appear to be cuticular knobs set regularly along the body. When observed in a scant amount of fluid these ridges are seen to cross the body with an irregular course, projecting slightly from it like a fringe. The ridges never inosculate with those from the other side of the lateral bands.

### *The Embryo.*

The embryos, taken from a freshly-cut nodul measure 0·22 mm. in length and 0 003 mm. in breadtb. When dried in a thin film upon a slide and stained with hæmatoxylin and eosin these embryos show a blunt rounded anterior end and a tapering finely pointed tail. The body is filled with deeply staining nuclei, except in the anterior 0·005 and the posterior 0·005 mm. The so-called break, which is the "anlage" of the nerve ring, is situated 0·055 mm. from the anterior end. No other clear spots are constantly present in the nuclear core.

### Nomenclature and Systematic Position.

Cleland and Johnston, of the Bureau of Microbiology, at Sydney, have recently contributed to the *Agriculture Gazette* of New South Wales a brief account of the parasite found by them in nodules from Queensland cattle.

Although their description differs in certain imporportant details,[1] notably in regard to the number and arrangement of the genital papillæ, from that given above, there can be practically no doubt that both descriptions relate to the same species of parasite, and it may be considered, from present knowledge, that the parasitic cause of the nodules in Australian cattle is of one species only.

I agree with these investigators in considering the parasite of cattle to be different from that of horses, with which it has been for so long confounded.

The main points of difference are shown in the following table :—

| Horse parasite—*O. reticulata* (according to Pader) | Cattle parasite—*O. gibsoni* (R.T.L.) |
|---|---|
| *Male :* | |
| Length : over 15 cm. .. .. | 5 cm. |
| Diameter : 0·09 mm. .. .. | 0·15 mm. |
| Papillæ six pairs, three preanal .. | Six pairs, four adanal, two caudal. |
| Spicules 260 $\mu$ and 100 $\mu$ .. .. | 180 $\mu$ and 80 $\mu$. |
| *Female ;* | |
| Length of œsophagus 3·5 mm. .. | 1 mm. |
| Vulva from anterior end 0·4 mm... | 1·23 mm. |
| Mamelon and three papillæ, just behind vulva. | None. |
| Eggs ; 45 $\mu$ to 50 $\mu$ by 30 $\mu$ to 35 $\mu$.. | 40 $\mu$ by 30 $\mu$. |

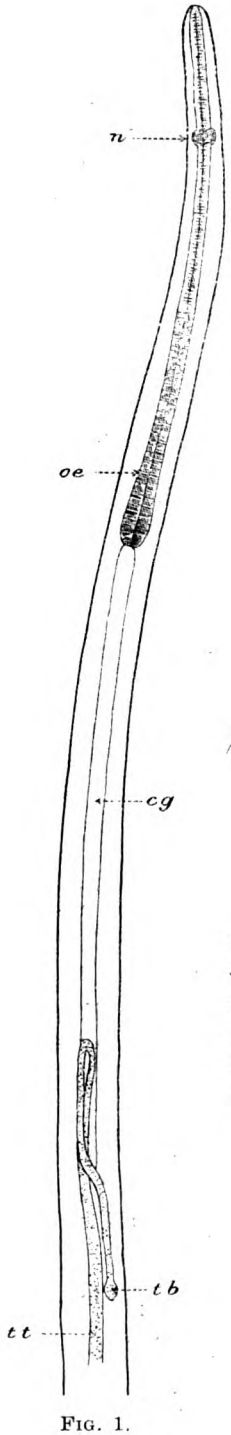
Cleland and Johnston also came to the conclusion, not only that the parasite of cattle differed from *Spiroptera reticulata* of the horse, but that it was new to science and peculiar to Australia. They, therefore, proposed the new name *Filaria gibsoni.*

In 1892, Stiles, however, proposed the name *F. lienalis* for a long thin worm encysted in connective tissue between the spleen and the stomach in cattle in the United States. No description was published, the manuscript having been lost in the post. In a later paper, Stiles (1894) records the type specimens of *F. lienalis* under the name *Spiroptera reticulata*, having apparently come to the conclusion that his new form showed such close resemblance to the parasite of the horse as to render the erection of a distinct species unjustified.

It appears very probable that the cattle parasite in question is of the same genus as that met with in Australian cattle, and it would be instructive if the original specimens, which are still preserved in the National Museum of the United States, could be re-examined from this point of view.

Through the kindness of Dr. Daniels I have, in connection with the preparation of the present paper,

[1] In the Report of the New South Wales Government Bureau of Microbiology for 1909 (p. 91), Cleland and Johnston contribute a valuable article on *F. gibsoni*, in which they revise their previous description of the parasite. Their later account agrees much more closely with that given above. The publication referred to only reached this country after this report had gone to the printer.

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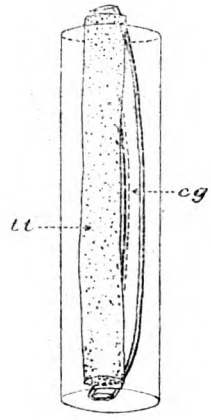


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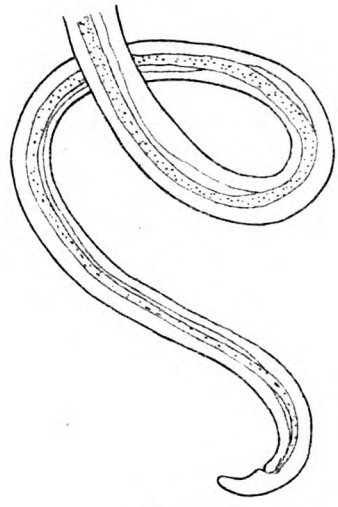

FIG. 3.

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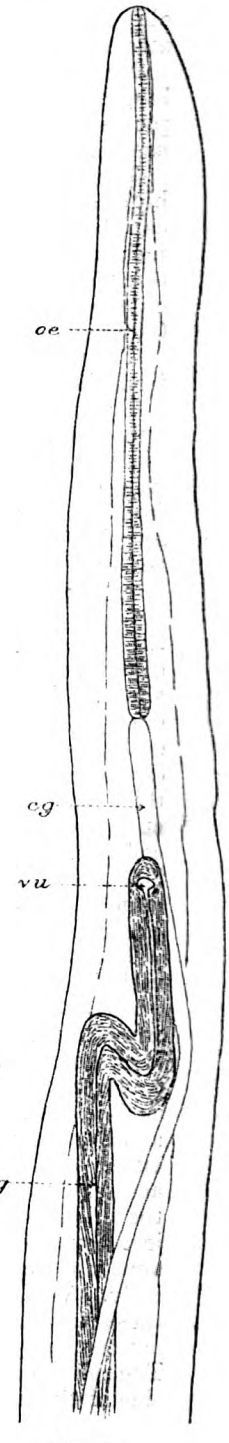


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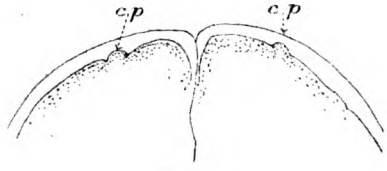



FIG. 6.

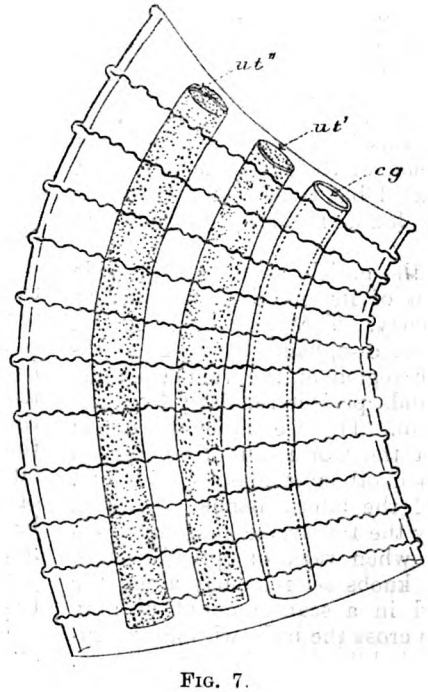
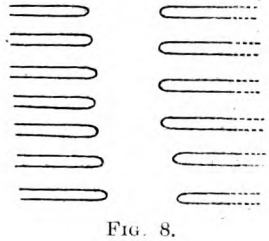



FIG. 7.



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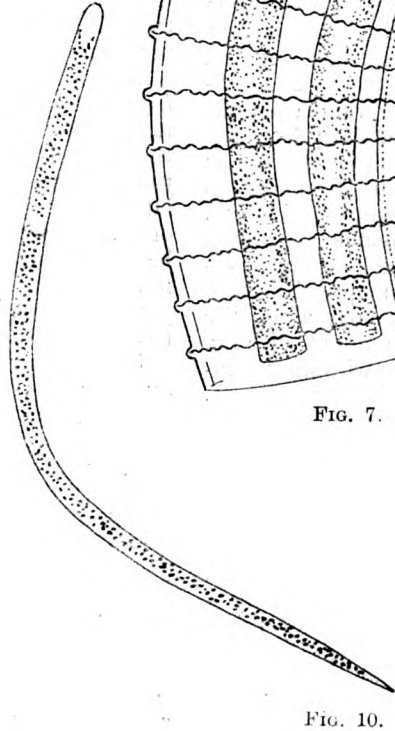
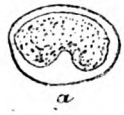


FIG. 10.



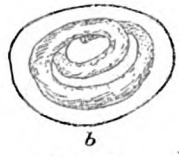




FIG. 9.

been enabled to examine the original material upon which the record of the discovery of the parasite in the Malay States by Ford in 1904 was based. The Malay parasite is of the same species as the *Onchocerca* in Australian beef, described above.

As regards the systematic position of the various species of worms that produce these so-called "worm-nests" in horses, cattle, and man, it should be noted that, in spite of the very close similarity between the species, the same authors frequently describe the individual species as of genera belonging to different

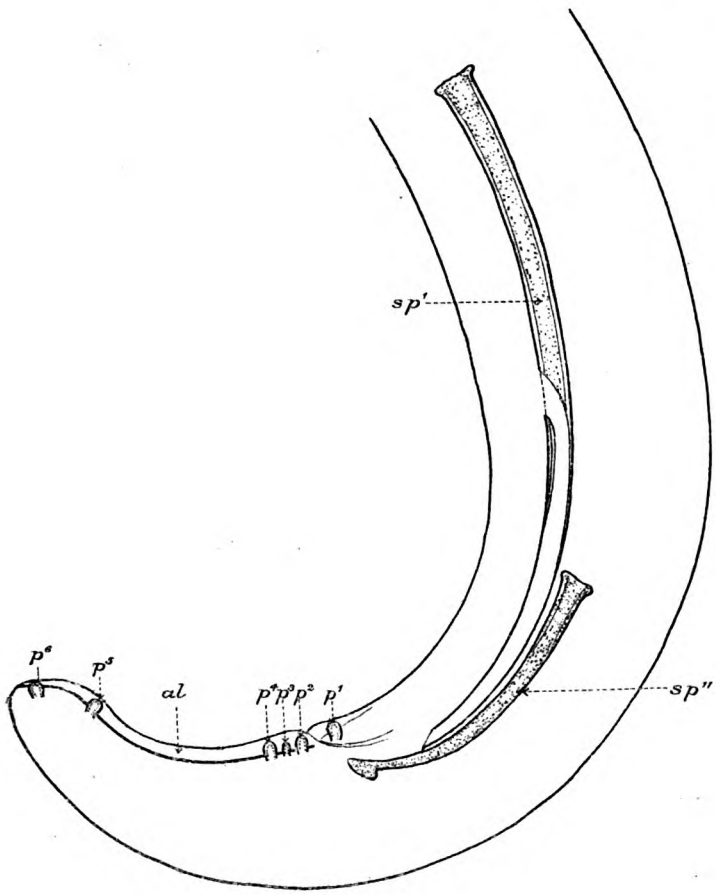



FIG. 11.

families. Thus *reticulata* is usually regarded as a species of *Spiroptera*, and *volvulus* has always been regarded as a species of *Filaria*. Cleland and Johnston write *Spiroptera reticulata* and *Filaria* (*Spiroptera*) *reticulata* in the same paper.

In 1909 the writer pointed out that *Spiroptera reticulata* and *Filaria volvulus* differed in many respects from the typical species of both genera, *Filaria* and *Spiroptera*, but that they were so obviously closely allied in structure and pathological effects as to deserve incorporation in a special genus in the family Filariidæ. He proposed the reinstatement of the generic name *Onchocerca*, created in 1841 by Diesing, but ignored by later writers. More recently, Railliet and Henry (1910) have adopted this view also.

The parasite of Australian meat may be designated, for the present, *Onchocerca gibsoni* (Cleland and Johnston, 1910).

The genus *Onchocerca*, like its ally the genus *Filaria*, belongs to the family Filariidæ, which embraces all those round-worms which are viviparous and live in the connective tissues, lymphatics or blood-stream of their host, and give rise to embryos without patent gut.

### *Life-history of the Parasite.*

So far as is known, no parasitic worm is able to develop to sexual maturity within the body of the host in which it received birth without first passing a more or less brief period of its life outside.

Certain of these worms can pass the necessary period outside the body in a free state, either still within the egg-shell or as active young, in soil or water. Others require to pass into the body of an invertebrate organism, therein to undergo a certain amount of development in order to attain to the degree of organization that will enable them to continue their existence and become sexually mature on regaining their warm-blooded host.

To the latter category belongs the family Filariidæ, the members of which, so far as they have been studied, have shown the common characteristic of requiring an arthropod for their larval development and for their conveyance from the infected animal to another. Thus, although nothing is at present known

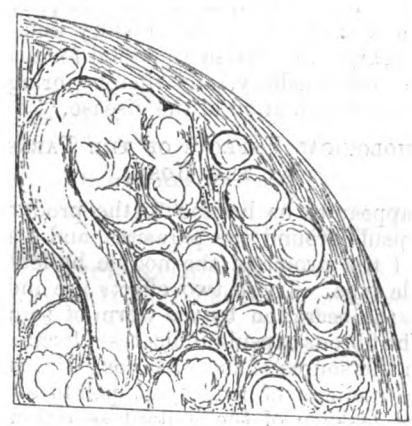


FIG. 12.

of the extra-corporeal life and mode of exit or entry of the host of any single species of *Onchocerca*, yet, because of the structural relationship of *Onchocerca* to other members of the family Filariidæ, the following statements regarding the species producing Onchocerciasis in Australian cattle can be made with considerable confidence:—

(1) Although the female within the body of its host produces hundreds of thousands of living young, not one of these can undergo direct development. An intense infection of the host results from an intense and repeated infection from outside.

(2) These young must be taken up and pass a certain period of time, perhaps about three weeks, in the body of some arthropod—crustacean or insect.

Thus, development of the parasite in man, as a result of the consumption of food containing these young in a living state, is impossible.

(3) The structure both of adult and young indicates that the parasite belongs to that division of the family Filariidæ that requires an insect as intermediary; not to the division in which an aquatic arthropod is the essential carrier. This view is further supported by the fact that careful investigation of parasites with this structure has failed to reveal any evidence that the adult worms normally discharge their young into water from a broken surface. Moreover, even in minute detail, the structure of the young closely corresponds to that of those known to develop in biting insects, and leave and enter the body by their means alone.

The implication of some biting insect in the transmission of Onchocerciasis is thus indicated; most probably the intermediate host will be found to be a Stomoxys, Hippobosca, Tabanid, or one of the Ixodidæ.

In view of the intense infections that occur in certain districts and of the evidence pointing to the fact that every worm found in the body has entered as a microscopic larva from an intermediary, it should not be difficult, by systematic dissection of the various biting flies in the infected area, to determine which is the actual carrier of round-worm embryos, and then to demonstrate experimentally the connection of these with the production of the disease. Once this connection were established, it should not prove impossible, from a study of the life-history and habits of the special carrier, to devise a method for the destruction of the intermediary, and thereby bring about a diminution or elimination of the disease.

### Pathological Effects of the Parasite on the Host.

These appear to be limited to the production of a fibrous capsule around the parasites, and a secondary invasion of the stroma of the nodule by leucocytes of eosinophile type. These two effects are independent results of the secretion by the worm of some irritant toxin. The fibrous capsule indicates a local endeavour to wall in the source of the irritation; the presence of the large numbers of leucocytes points to a certain amount of leakage of the irritant secretion into the system.

A good deal of attention was directed in the course of my investigations to the question as to the escape of the embryos from within the capsule. The lymph in the interstices of the fat surrounding the nodules, the blood in the neighbouring veins, and the synovial fluid from the joints were collected and microscopically examined, but in no instance was a young worm found. In the examinations of frozen meat made at the Port of London, neither adult worms nor their young have been discovered in any part of such meat, save where they are enclosed in visible fibrous capsules.

Experiments were also made with a view to restoring the worms or their young to animation by gentle heat. These were entirely unsuccessful. Most probably the mature worms die within a few hours of the death of the animal in which they live. The young probably live a little longer, but the lack of oxygen and the low temperature and prolonged effect of cold storage quickly destroy their vitality.

It is to be expected that in the living host, the young embryos, on escaping from their mother, do get into the lymph or blood stream, and in this way are taken up by their intermediate host. This expectation is not at first sight to be reconciled with the encapsulation of the female worms and her progeny in dense fibrous coverings, and the apparent absence of the embryos from other parts. It may be suggested here, however, that the connective tissues may not be the *normal* habitat of the worm. Pader has remarked that those specimens of *Onchocerca reticulata* in the horse that were in tendons appeared to be able to migrate at will, and were not enclosed in limiting capsules. The tendons appeared to be the normal habitat of that species. He noticed, however, that several worms sometimes lay in the connective tissue alongside the tendons, and in these cases were invariably surrounded by fibrous coatings and often had become calcified. *O. reticulata* has also been occasionally found in the arteries.

Railliet, in a recent paper, records the presence of another species, *O. reticulata*, in the wall of the aorta in cattle — zebu and buffalo of India and Sumatra.

In the *Onchocerca* of Australian cattle one frequently finds that some of the nodules contain dead and calcifying worms similar to those described by Pader. So that it is not impossible that a detailed examination of the viscera (which, of course, do not reach this country) may reveal the *O. gibsoni* in its normal habitat unsheathed in a restraining capsule and, therefore, able at certain times to throw into the blood or lymph stream her numerous progeny; thus giving them the opportunity of entering another sphere and becoming parents in turn.

In those cases where calcification of the mature worm has occurred, certain concomitant changes take place within the capsule. The body of the worm becomes infiltrated with chalk and the surrounding loose stroma in the centre of the nodule breaks down. This broken-down material might conceivably become secondarily infected with bacteria.

It is noteworthy here that Park (1893) claimed to have found such broken-down nodules the origin of tuberculosis, and to have demonstrated in them the tubercle bacillus. He traced also actinomycosis to a similar antecedent condition. So far as I have been able to ascertain these observations stand unconfirmed.

When thawed and seen cut across, the nodules have a glairy and repellent appearance; they are often numerous and of no little bulk in a circumscribed area.

In view of the degree of leucocytic infiltration of the infected tissue and the definite indication, from the presence of the thick fibrous coating, that the worms produce an irritant secretion I do not agree with Drs. Cleland and Johnson that, "from the butcher's standpoint they may be viewed as interfering merely with the general appearance of the affected part," or that from the point of view of the general public "they may be looked on as pathological curiosities."

The capacity of the parasite to produce irritant substances and inflammatory products of the kind referred to would seem to me to render their presence in meat intended for human consumption to be most undesirable.

Further, it would be a distinctly retrogade step if the public were taught to ignore, as innocuous, the presence of parasitic cysts in beef or pork. It could scarcely be expected that a sharp distinction between, say, the "measles" in beef and pork infected with human tapeworm and the "worm-nests" in frozen beef would be understood or appreciated.

In conclusion, I must express my sense of indebtedness to the Veterinary Inspector of the Corporation of London, Mr. T. Dunlop Young, M.R.C.V.S., who not only placed at my disposal a large quantity of infested meat, but in other ways did much to facilitate my investigations.

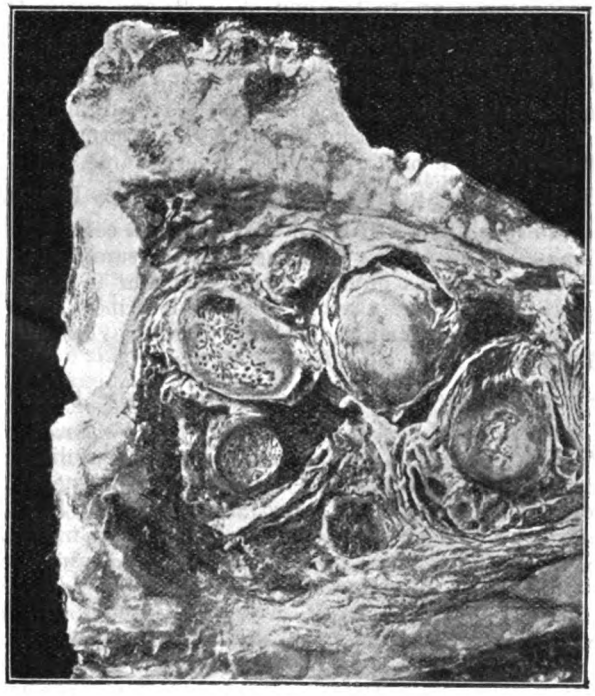


FIG. 13.

## SUMMARY AND CONCLUSIONS.

(1) The parasitic nodules in Australian beef are, without exception, due to the presence of long thread-like worms of the genus *Onchocerca*.

(2) The diseased condition, Onchocerciasis, is not peculiar to Australian cattle, but occurs also in other animals and in various parts of the world, including the United States of America.

(3) The parasites belong to a group of worms that require to be taken up by a biting insect, and to undergo a certain degree of development therein before they can be transmitted to another warm-blooded animal.

(4) The worms and their young do not appear to be capable of surviving for more than a few hours the death of the cattle. No evidence of vitality of the worm or its embryo has been met with in the case of Australian beef reaching this country.

(5) From (3) and (4) above, it follows that the direct development of the parasite in man as a result of eating the affected meat is impossible.

(6) The nodules are the product of changes taking place in the tissues as a result of some acrid toxin excreted by the worms. In my opinion their presence in meat intended for human consumption is undesirable for this reason.

R. T. LEIPER.

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## EXPLANATION OF FIGURES.

FIG. 1.—Anterior end of male worm, showing—*oe*, œsophagus; *n*, nerve ring; *cg*, chyle-intestine; *tt*, testicular tube, ending in small bulb *tb*.

FIG. 2.—Middle of same worm, showing increase in breadth; also *cg* and *tt*, as above.

FIG. 3.—Outline of posterior end of same specimen.

FIG. 4.—Skin of male worm under high magnification, showing simple transverse striation.

FIG. 5.—Anterior end of female, showing—*oe*, *cg*, as in fig. 1; *vu*, vulva; *vag*, vagina.

FIG. 6.—Anterior end of female, showing circumoral papillæ *cp*; visible only under oil-immersion lens.

FIG. 7.—Piece of female worm from about middle of body, showing fringe-like transverse markings on skin and, within, *cg*, gut, and $ut^{I}$, $ut^{II}$, portions of the two uteri.

FIG. 8.—Lateral band in anterior part of worm, showing the manner in which the transverse markings (in this region, simple) end.

FIG. 9.—Ova of worm at different stages (*a*) and (*b*) of growth.

FIG. 10.—The embryo.

FIG. 11.—Posterior extremity of the male worm showing the *p*, genital papillæ; $sp^{I}$, $sp^{II}$, spicules; *al*, ala; the papillæ are paired, but only one side is drawn.

FIG. 12.—Drawing of a slice through a quarter of a nodule; the cut pieces of worm have been removed to show the tunnels left in the fibrous capsule.

FIG. 13.—Photograph of a piece of beef in which an unusually large number of nodules is present. Some have been cut across and show cut ends of the parasite in the centre of the nodule ($\frac{2}{3}$ natural size).

## (b) A Summary of Current Helminthological Literature.

### A NEW ANKYLOSTOME FROM BRAZIL.

(*Memorias do Instituto O. Cruz*, ii. (2), p. 286.)

Dr. Gomes de Faria records the occurrence of a new species, *Anchylostomum braziliense*, which formed no less than a third of a hundred specimens of ankylostome worms collected from the intestines of cats and dogs at Manguinhos. The remainder were all *A. caninum*.

*Anchylostomum braziliense* has a maximum length on an average of 7·5 mm. in the male and 8·5 mm. in the female. The skin is thin. The ventral margin of the mouth carries on each side of the middle line a large triangular tooth, the sharp points of which are bent down and backwards. In the superior and internal angle of these teeth is a small accessory tooth.

The inner ventral teeth are short, blade-like and triangular. The spicules are very long, dark yellow, with flattened anterior extremities, are transversely striated, and end in extremely fine points. The posterior ray divides near its tip into two portions, each at once dividing again to form two short rays. It is regrettable that the author has not contrasted the new form with *A. perniciosum*, and other species described from Asiatic felines.

### A MODIFICATION OF THE SERUM TEST FOR HYDATIDS.

(*Archivos do Instituto Bacteriologico Camara Pestana*, vol. iii., pt. 2.)

A serum test for the diagnosis of echinococcus infection of man has now quite definitely entered the realm of practical medicine. Ghedini, some years ago, applied the reaction of fixation of complement to the diagnosis of this disease. In 1907, Fleig and Lisbonne showed that the mixture of fresh serum with hydatid fluid gave a definite precipitin reaction.

Weinberg and others have since shown that the fixation of complement is a much more delicate test of the presence of antibodies in the serum of hydatid patients than is the precipitin test. Nevertheless, this reaction sometimes fails, especially in cases in which the cyst has suppurated.

N. Bettencourt, by applying a hæmolytic system of human red blood corpuscles, and rabbit-homo serum similar to that suggested by Noguchi, for syphilis has been able to obtain positive reactions which were confirmed by operation, in cases where the precipitin and the Bordet-Gengou reactions had failed.

R. T. Leiper, M.B., F.Z.S.,
*Helminthologist to the London School of Tropical Medicine.*

## Parasitology.

### The Hæmatozoa of Portuguese Guinea.[1]

Franca describes two species of hæmogregarines, a new trypanosome, and a new genus of endoglobular parasite in the toad *Bufo regularis*, viz., *Hæmogregarina pestanæ*, n. sp., *Hæmogregarina* sp.? *Trypanosoma bocagei*, n. sp., and *Toddia buffonis*, n. g., n. sp. He records also a large trypanosome from *Mabuia perroteti* as a doubtfully new species under the name *T. perroteti*.

### The Hæmogregarines of Tortoises in Portugal.[1]

Franca re-describes the Hæmogregarines that have been found in the two tortoises *Clemmys leprosa* and *Emys orbicularis*.

### The Leucocytozoon of Mus decumanus.[1]

Franca and Pinto review the literature of the leucocytozoa up to the end of 1909, and group the hæmogregarines and leucocytozoa together as two genera — *Hæmogregarina*, Danilewsky, 1885, and *Leucocytogregarina*, Porter, 1909, in the family *Hæmogregarinidæ*, Neveu-Lemaire, 1901. It is difficult to follow their argument for rejecting *Hepatozoon*, Miller, 1908, in favour of Porter's later generic name.

### Contributions to the Protozoan Fauna of Brazil.[2]

Prowazek lists 116 free-living protozoa collected in Brazil. None are new to science. In the same number Hartmann writes on the nuclear division in *Amœba hyalina*, and Dr. Carlos Chagas describes a new coccidium from the gut of a bug, *Dysdercus ruficollis*, The species is named *Adelea hartmanni*.

### Sixteen New Species of Simulium from Brazil.[3]

Dr. Adolf Lutz contributes to the *Memorias do Instituto O. Cruz* a second paper on the Simulidæ of South America, adding to those previously listed the following new species: *Simulium infuscatum*, *S. subnigrum*, *S. distinctum*, *S. incrustatum*, *S. auristriatum*, *S. subpallidum*, *S. flavopubescens*, *S. pruinosum*, *S. simplicicolor*, *S. minusculum* (*amazoni Goeldi*), *S. clavibranchium*, *S. æquifurcatum*, *S. brevifurcatum*, *S. incertum*, *S. hirtipupa*, *S. subclavibranchium*. The name *S. nigrimanum* is replaced by a new name, *S. orbicale*, n.n. Descriptions of six other species, already known to science, are also given.

### Protozoa in Musca domestica.[3]

Flu, writing from Paramaribo in Surinam on the parasites of the common house-fly, describes at some length three parasitic protozoa, *Leptomonas muscæ domesticæ*, *Herpetomonas muscæ domesticæ*, and a new species of Schizogregarine, to which the name *Octosporea muscæ domesticæ* is given.

The mode of transmission from fly to fly in the case of the *Herpetomonas* is from the presence of cysts in the stools and, from these, flagellate forms develop in the fæces. In *Leptomonas* from cysts, and Leptomonad forms in the fæces. In *Octosporea* from crescent-shaped spores in the stools.

[1] *Archivos do Instituto Bacteriologico Camara Pestana*, tome iii. Fasc. 2, January, 1911.
[2] *Memorias do Instituto Oswaldo Cruz*, vol. ii., part 2, 1910.
[3] *Centralbl. f. Bakt.*, Orig., Bd. 57, Heft 6, February 18, 1911.

## Appliances.

*A New Mosquito Net.*—Recently a new mosquito net technically know as the "*Mida*" *mosquito net*, has been placed on the market.

The chief feature of this net are the fineness of the mesh, and the protection it affords to the hands should they come into contact with the net, owing to the lowest two feet of the net being made of stout calico, which is impervious to the bite of the mosquito.

All the foremost authorities on Tropical Hygiene assert that mosquito nets should invariably be tucked under the mattress of the bed, and this procedure requires the presence of strong material. Without the calico the net soon becomes torn, when it is no longer a protection but a source of danger.

The "Mida" mosquito nets are made in two sizes, one for single beds and the other for double beds; and of both sizes two shapes are made, the one pyramidal, for suspension from the ceiling, and the other rectangular, to be tied to the four posts of the bedstead.

Firmly sewn to the four corners of the calico top are pieces of strong tape with which the net is tied to the four rings at the extremities of the two pieces of cylindrical wood by means of which it is suspended. The two pieces of wood are pivoted together at the middle—one above the other—by a screw eye. A short length of cord and a screw eye for suspending the net to the ceiling are supplied.

When ordering a "Mida" mosquito net care should be taken to state the size and shape required, otherwise the single pyramidal net, as being that in most general request, will be supplied.

The circumference at the base measures, for a single bed, 20 ft., and for a double bed 25 ft.

In the case of the square form of net the top, which is also made of calico, should be of the same dimensions as the base, 3 ft. 3 in. by 6 ft. 9 in. for a single bed, and 5 ft. 6 in. by 7 ft. for a double bed. The height of mosquito netting—that is, from top to calico base—equals 4 ft.

The "Mida" net is the strongest and most durable net on the market. Moreover, it folds into a small compass and can conveniently be carried in the traveller's portmanteau.

This net can be obtained from the Tarkwa (Gold Coast) Trading Company, Limited, 164, Palmerston House, Old Broad Street, London, E.C., who will also be pleased to show it to any one interested. The price is quite moderate.

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*A New Automatic Water Sterilizer.*—The necessity of devoting attention to water required for drinking purposes is now universally recognized, both at home and in the Tropics. Filters are often unreliable and boiling is the only trustworthy method of sterilization. Boiling the water in ordinary kettles is useful as far as it goes, but in many ways is unsatisfactory owing to the amount of personal supervision that is required. Allen and Hanburys, Limited, realizing this, have brought out a new automatic water sterilizer which they claim will always guarantee a pure water supply, thus removing a constant source of worry and giving security in times of epidemics. The "Macnair" automatic water sterilizer, as the new apparatus is called (diagram), is a simple contrivance which consists of two cisterns, fitted one on top of the other. The lower is a boiler, practically steam-tight, the upper a locked reservoir. These are connected by a pipe up the centre. The capacity of the reservoir is sufficient for a day's supply, and no water can enter it except through the connecting tube.

Capacity .. 2 gallons.

A, boiler; B, reservoir; C, connecting tube; D, whistle; E, opening for filling boiler; F, opening for cleaning boiler.

The boiler is filled with water through a small opening which is closed by a screw nut. The apparatus is then completely shut and the boiler becomes practically steam-tight. It is then placed on the fire, and when the water boils, the steam generated forces the sterilized water up into the reservoir, from whence, after cooling, it can be drawn off by the tap.

As the apparatus is absolutely automatic in action, it is naturally very simple to work, and as it is well made in copper and there are no parts that can break or get out of order, it causes no trouble. Again as it is much more rapid in action than a still it is consequently more economical. The sterilizer prevents the insipid taste of ordinary boiled water, because directly boiling commences the water is forced into the reservoir and little of the air originally present is lost. In using it the following hints should be observed:—

(1) The central tube must be kept clear. A brush is supplied, and the tube should be frequently cleaned.

(2) Deposits in the boiler cause waste of food fuel, and should be removed from time to time. Some deposits are easily removed by using the scraper specially supplied for the purpose, others by boiling with soda.

(3) If the water contain gross impurities the boiler should be filled only by means of the filter filler provided, and should be cleaned through the bottom opening.

In addition to the ordinary model shown in the diagram, a camp model in a special collapsible form is made, this being specially useful for travellers or those living in camps. The prices of these are £2 15s. and £2 10s. respectively.

## Annotations.

*The Cultivation of the Lepra Bacillus.*—Duval and Gurd of New Orleans write in the *Archives of Internal Medicine* for February, 1911, on the biology of and immunity against the bacillus of leprosy. They state that the *Bacillus leprœ* may be cultivated on a variety of artificial media, and is capable of living and retaining its infectibility for months under adverse conditions outside of the animal body. Further they claim that the bacilli can also be cultivated from contaminated leprous tissue and from the nasal discharge that has been kept at room temperature for more than a year. Contaminating organisms apparently have no appreciable effect on the viability and infectivity of some strains of the lepra bacilli. Pure cultures can be obtained directly from the infected leprous tissue on a variety of special media, including tryptophan and glycerinated blood agar, without first growing them in the presence of amœbas and their symbiotics. The authors cultivated in pure growth the specific organism directly from two cases of leprosy on Novy-McNeal rabbit blood agar to which 1 per cent. glycerin had been added. Multiplication takes place slowly on artificial media, but once the growth has started it can be readily accelerated by frequent transplantations. That the cultures are leprosy bacilli, and not some other acid-fast species, they state, has been definitely proved by cultural and animal tests. White and Japanese dancing mice have been successfully infected, and lesions have also been produced in monkeys by the authors. As regards the spread of the disease from man to man they believe direct inoculation may occur but it is the exception. Indirect transmission is more likely they think and their investigations also confirm the belief that the mucous membrane of the nasal pharynx is the port through which the bacilli gain entrance to the body as well as the chief source from which infection spreads.

*The Nature of the Virus of Yellow Fever, Dengue, and Pappataci Fever.*—In the *New York Medical Journal*, February 25, 1911, is published a very interesting paper by Charles F. Craig which was read in the "symposium" upon the "Filterable Viruses" before the section in physiology and experimental medicine of the American Association for the advancement of science at Minneapolis, Minn., on December 29, 1910. In this paper the close similarity which exists between the virus of yellow fever, dengue and pappataci fever is admirably pointed out. Clinically, as the author says, there is a resemblance between these three diseases, all having a sudden onset, running a rapid course and terminating by crisis rather than lysis. Striking as are these facts however, Craig next shows that the work done on their etiology is still more so. In all three the cause is present in the blood, but only during certain periods; in yellow fever during the first three days of the disease; in pappataci fever during the first day, and in dengue as far as is known during the third and fourth days of the attack. In all the injection of both filtered and unfiltered blood produces the disease, while, further, all are transmitted by insects—two by mosquitoes, the other, pappataci fever, by a biting fly (the *phlebotmus*). In yellow fever the average period of incubation after the bite of the infected insect is three days, eighteen hours; in dengue, four days, eighteen hours; and in pappataci fever, five days, twenty hours. In all three diseases the causative agent is ultramicroscopical in size, as it passes through the best filters that can be obtained, and because the most careful examinations of the blood, both microscopically and culturally, have always failed to show any parasites. Finally there is conclusive evidence to show that none of these three diseases is contagious. Tabulated like this, as Dr. Craig has done, the resemblance is very striking, and his idea that in time it will be proved that these fevers are due to closely-related species belonging to the same genus, probably protozoal in nature, is very likely correct.

## NOTICES.

### The Seventeenth International Congress of Medicine.

The Seventeenth International Congress of Medicine will meet in London in the summer of 1913. The exact date is to be fixed by the International Permanent Committee, which will assemble for the first time in London, April 21 and 22 next, under the presidency of Dr. F. W. Pavy.

At the same meeting the list of sections of the Congress will be constituted. Any wishes or propositions concerning the arrangement of this list may be sent, up to April 1, to the Hon. General Secretary of the Permanent Committee, Professor H. Burger, Vondelstraat 1, Amsterdam, or to the Bureau of the Committee, Hugo de Grootstraat, 10, The Hague.

The Committee will be glad to receive, before the same date and at the same addresses, possible information and propositions concerning the organization of the Congress.

## Notices to Correspondents.

1.—Manuscripts sent in cannot be returned.

2.—As our contributors are for the most part resident abroad, proofs will not be submitted to those dwelling outside the United Kingdom, unless specially desired and arranged for.

3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.

4.—Authors desiring reprints of their communications to the Journal of Tropical Medicine and Hygiene should communicate with the Publishers.

5.—Correspondents should look for replies under the heading "Answers to Correspondents."

## Original Communications.

# EXPERIMENTS TO ASCERTAIN IF THE DOMESTIC FOWL OF UGANDA MAY ACT AS A RESERVOIR OF THE VIRUS OF SLEEPING SICKNESS (*TRYPANOSOMA GAMBIENSE*).[1]

By Colonel Sir DAVID BRUCE, C.B., F.R.S., A.M.S., and Captains A. E. HAMERTON, D.S.O., and H. R. BATEMAN, R.A.M.C.

(Sleeping Sickness Commission of the Royal Society, Uganda, 1908-10.)

### INTRODUCTION.

BIRDS of various species are very numerous on the shores of Lake Victoria. Of these, cormorants, darters, herons (African grey and purple, and other species), ibises (glossy and sacred), fish-eagles, weaver birds (various species), terns (various species), gulls, geese (Egyptian and spur-winged), plovers (various species), pratincoles, storks, kingfishers and gallinules, are the most common. These birds all inhabit areas where the *Glossina palpalis* are numerous, and some evidence is forthcoming that in Nature the fly feeds on avian blood.[2]

In view of the continued infectivity of the fly in the depopulated areas of the Lake-shore, it is clear that every effort should be made to ascertain the source of such infectivity. Search for a reservoir of the virus of sleeping sickness at once suggests itself, and to those acquainted with the fauna of the Lake-shore an avain host would be included amongst the various species requiring investigation.

Domestic fowls were employed in these experiments. They are readily obtained, easily handled, and the flies feed greedily on them. One species of trypanosome may in nature only affect one species of avian host; therefore, it follows that whatever the result of this series of experiments may be, that result is only applicable to the fowl. The Commission trust that no wider significance will be attached to the conclusions set forth at the end of this paper: in other words, because a Uganda fowl is or is not a reservoir of *Trypanosoma gambiense*, it does not follow that a cormorant, or other bird, is or is not a reservoir. It would have been better for this reason to have experimented with one or other of the various species of wild Lake-shore birds. The difficulties were, however, too great at the time these experiments were carried out. It is hoped that this paper will stimulate rather than discourage other workers to carry on this line of investigation.

In order to discover whether Uganda fowls can act as a reservoir of the virus of sleeping sickness, the Commission asked themselves the following questions:—

(1) Can fowls be infected with the virus of sleeping sickness by the bites of laboratory-bred and laboratory-infected *G. palpalis* ?

(2) Can fowls transmit the virus of sleeping sickness (*T. gambiense*) to clean laboratory-bred *G. palpalis* ? If this is possible, can the flies so infected convey the virus to normal susceptible animals?

An answer in the affirmative to those two questions would throw suspicion on a possible avain host. To decide these points, the following experiments were devised and carried out:—

### CAN FOWLS BE INFECTED WITH THE VIRUS OF SLEEPING SICKNESS (TRYPANOSOMA GAMBIENSE) BY THE BITES OF LABORATORY-BRED AND LABORATORY-INFECTED GLOSSINA PALPALIS?

The method adopted to infect the fowls was carried out as follows: Clean *G. palpalis*, hatched out in the laboratory, were given their first feeds on a monkey whose blood contained many *T. gambiense*. An interval of at least twenty-four hours was then allowed to elapse before the infected flies were first fed on the fowl. The fowl was then fed on, for varying periods, by these flies. To make certain the flies were infective, their infectivity was usually tested by their being allowed to bite normal susceptible animals during the experiment. Finally, to discover if the fowl had become infected with *T. gambiense* by the bites of the *G. palpalis* :—

(*a*) The fowl's blood was examined frequently throughout the experiment for *T. gambiense*.

(*b*) The fowl was killed and its centrifuged heart or jugular vein blood was carefully examined microscopically for *T. gambiense*.

(*c*) Two or more cubic centimetres of the centrifuged blood were injected into a normal susceptible animal on one or more occasions during the experiment.

Two typical experiments are given in detail.

*Experiment* 1915*a*.

| Date | Day of experiment | Procedure | Result | Remarks |
|---|---|---|---|---|
| 1909 Nov. 22—25 | 1—3 | Flies fed on *T. gambiense*-infected monkey | | 250 laboratory-bred *G. palpalis* used |
| ,, 26—Dec. 31 | 4—39 | Flies fed on cock 1926 | – | *T. gambiense*-infected flies found on Dec. 13, 14, 16, 17, 20, and 27 |
| 1910 Jan. 1—10 | 40—49 | Flies fed on normal monkey, Experiment 1999, to test their infectivity | | 100 flies of this experiment survived to 50th day and were used for Experiment 1915*b* |
| ,, 11 .. | 50 | Monkey, Experiment 1999, examined; blood showed *T. gambiense* | + | Allowing seven days for the incubation of *T. gambiense* in this monkey, it is seen that the flies infected it on Jan. 4—that is, four days after feeding on fowl |

*Remarks.*—On December 17, 1909, 1 c.c., and on December 22, 3 c.c. of the blood of cock, Experiment 1926, were injected into a normal monkey, Experiment 1954. This monkey remained healthy. On January 10, 1910, the cock was killed, 10 c.c. of its heart's blood were centrifuged, and the "buffy layer" carefully examined for *T. gambiense*, with negative results. The whole of the 10 c.c. of blood obtained were then injected into two monkeys: 5 c.c. into monkey, Experi-

[1] A Communication read before the Royal Society, January 19, 1911.

[2] *Proceedings of the Royal Society*, B, 1910, vol. 82, p. 496, table iv.

ment 1954, and 5 c.c. into monkey, Experiment 2054. The blood of these two animals was examined frequently for a month after these injections. No trypanosomes were ever found and the monkeys remained healthy.

*Experiment* 2081.

| Date | Day of experiment | Procedure | Result | Remarks |
|---|---|---|---|---|
| 1910 Jan. 9—14 | 1—5 | Flies fed on *T. gambiense*-infected monkey | | 120 laboratory-bred *G. palpalis* used |
| ,, 15—Feb. 2 | 6—24 | Flies fed on cock, Experiment 2074 | – | Feb. 15, monkey, Experiment 2135, showed *T. gambiense* in its blood |
| Feb. 3—7 | 25—29 | Flies fed on normal monkey, Experiment 2135, to see if flies are infective | + | Feb. 22, monkey, Experiment 2178, showed *T. gambiense* in its blood |
| ,, 8—14 | 30—36 | Flies again fed on cock, Experiment 2074 | – | Fowl, Experiment 2074, has therefore been fed on by infective *G. palpalis* |
| ,, 15—19 | 37—41 | Flies fed on normal monkey, Experiment 2178, to see if flies still infective | + | |

*Remarks.*—Cock, Experiment 2074, was killed on March 16, 1910; 10 c.c. of its heart's blood were taken and centrifuged and carefully examined for *T. gambiense*, with negative results. The 10 c.c. were then injected, subcutaneously, into normal monkey, Experiment 2301. This monkey was examined bi-weekly up to April 15, 1910. No *T. gambiense* were ever seen, and the monkey remained healthy.

TABLE I.

| No. of experiment | No. of flies used | No. of fowl fed on | No. of infected flies found during experiment | Result | Remarks |
|---|---|---|---|---|---|
| 1915*a* | 250 | Expt. 1926 | 7 | Negative | Proved infective flies fed on this fowl |
| 1915*b* | 100 | ,, 2059 | 1 | ,, | Proved infected flies fed on this fowl |
| 1915*c* | 50 | ,, 2182 | — | ,, | Doubtful whether infected flies fed on this fowl |
| 1918 | 100 | ,, 1927 | — | ,, | Proved infective flies fed on this fowl |
| 2081 | 120 | ,, 2074 | 2 | ,, | Proved infected flies fed on this fowl |
| 2082 | 100 | ,, 2087 | 12 | ,, | Proved infected flies fed on this fowl |
| 2208 | 100 | ,, 2209 | 0 | ,, | Proved infective flies fed on fowl, but no flies dissected |
| 2325 | 160 | ,, 2334 | 2 | ,, | Proved infective flies fed on fowl |
| 2362 | 110 | ,, 2363 | 7 | ,, | Proved infective flies fed on fowl |
| 2365 | 300 | ,, 2336 | 0 | ,, | Flies not dissected, but were proved infective |
| 2366 | 150 | ,, 2364 | 0 | ,, | Flies not dissected, but were proved infective |
| 2390 | 180 | ,, 2367 | 7 | ,, | Proved infective flies fed on fowl |
| 2395 | 100 | ,, 2396 | 1 | ,, | Proved infective flies fed on fowl |

*Remarks.*—In these experiments it is seen that 1,820 laboratory-bred and laboratory-infected *G. palpalis* were fed on thirteen fowls, with uniformly negative results. With one exception, Experiment 1915*c*, the flies were proved to be infective by feeding them on animals susceptible to *T. gambiense* infection. That the fowls had not become infected with *T. gambiense* was proved by carrying out the three tests given above, under headings *a*, *b*, and *c*. In Experiment 2325, the liver, spleen and bone-marrow of Fowl 2334 were also examined for trypanosomes, and 10 c.c. of the pooled pulp injected into a normal monkey. This monkey remained healthy.

The thirteen experiments carried out on these lines are given in tabular form, in Table I above:—

A further series of experiments bearing on this question was carried out. These experiments are not so complete. The procedure was as follows:—

A varying number of laboratory-bred *G. palpalis* were fed for several days on *T. gambiense*-infected antelope. The infected flies were then fed for varying periods on fowls. The fowls were then killed and 2 c.c. of their blood were injected into a normal monkey. The monkey's blood was examined for *T. gambiense* bi-weekly for a month after the injection of the fowl's blood. The experiments are given in tabular form.

TABLE II.

| Date | Days of "cycle" the flies fed on fowl | Experiment No. of fowl | No. of flies used | Did flies subsequently prove to be infective? | Result of inoculation of fowl's blood into normal monkeys |
|---|---|---|---|---|---|
| 1910 May 9—21 | 7—19th | Cock 2455 | 50 | No | Negative |
| ,, 13—31 | 4—22nd | ,, 2471 | 60 | Yes (18 p.c.) | ,, |
| ,, 16—June 1 | 7—23rd | ,, 2479 | 95 | ,, (2·1 p.c.) | ,, |
| ,, 16—June 1 | 4—20th | ,, 2480 | 55 | ,, (15 p.c.) | ,, |
| June 2—11 | 10—19th | ,, 2518 | 100 | No | ,, |
| ,, 2—14 | 5—17th | ,, 2519 | 100 | ,, | ,, |
| ,, 2—17 | 8—23rd | ,, 2519 | 100 | Yes (8·8 p.c.) | ,, |
| ,, 2—11 | 11—20th | ,, 2519 | 100 | No | ,, |

*Remarks.*—The chief criticism against these experiments is the fact that the flies fed on the fowls during the earlier days of the experiments, when the *G. palpalis* are usually not infective. However, as results have been recorded by the Commission where *G. palpalis* have infected susceptible animals as early as the 18th day of an experiment, it has been decided to publish these experiments.

## CAN FOWLS TRANSMIT THE VIRUS OF SLEEPING SICKNESS TO CLEAN LABORATORY-BRED GLOSSINA PALPALIS? IF THIS IS POSSIBLE, CAN THE FLIES SO INFECTED CONVEY THE VIRUS TO NORMAL SUSCEPTIBLE ANIMALS?

In view of the results obtained by the first series of experiments, it would seem somewhat unnecessary to follow this question further.

It has so far been proved that the blood of fowls which have been fed upon by infected *G. palpalis* is non-infective when injected into susceptible animals. It has now to be ascertained if the blood of such fowls is also incapable of infecting the fly. This would constitute additional evidence against the fact that fowls act as a reservoir of *T. gambiense*.

Cages of laboratory-bred and laboratory-infected *G. palpalis*, which were known to be infective, were fed on fowls for a varying number of days. Next,

clean laboratory-bred flies were fed on these fowls for several days. The flies were then fed on normal susceptible animals (monkeys), in the endeavour to infect such animals with *T. gambiense*, and so prove that the blood of the fowl was infective. The full details of three experiments are given below:—

*Experiment* 2018.

| Date | Day of experiment | Procedure | Result | Remarks |
|---|---|---|---|---|
| 1910 Jan. 4—10 .. | 1—6 | Flies fed on Fowl 1927 | | 100 laboratory-bred *G. palpalis* used. Fowl, Experiment 1927, has been fed on for 29 days by *T. gambiense*-infected *G. palpalis*. |
| ,, 11 .. | 7 | Flies starved | | |
| ,, 12—Feb. 23 | 8—50 | Flies fed on Monkey 2061 | – | 87 *G. palpalis* dissected throughout this experiment between the 11th and 55th days after flies' first feed on Fowl 1927. All were negative for flagellates. Monkey 2061 examined, with negative result, till March 7. |

*Experiment* 2019.

| Date | Day of experiment | Procedure | Result | Remarks |
|---|---|---|---|---|
| 1910 Jan. 4—10.. | 1—6 | Flies fed on Fowl 1926 | | 104 laboratory-bred *G. palpalis* used. Fowl, Experiment 1926, has been fed on for 29 days by *T. gambiense*-infected *G. palpalis*. |
| ,, 11 .. | 7 | Flies starved | | |
| ,, 12 to Feb. 23 | 8–50 | Flies fed on Monkey 2062 | – | 80 *G. palpalis* dissected throughout this experiment between the 11th and 55th days after flies' first feed on Fowl 1926. All were negative for flagellates. Monkey 2062 was examined bi-weekly for *T. gambiense* until March 22; no trypanosomes were seen. Monkey remained healthy. |

*Remarks.*—It will be seen that 400 laboratory-bred *G. palpalis* fed on the three fowls, Experiments 1927, 1926, and 2087, subsequently failed to infect monkeys with the virus of sleeping sickness, and that all the 283 Glossina dissected throughout these experiments were negative for flagellates. This absence of flagellates in the flies is interesting, because Fowl 1927 and Fowl 1926 were both found to be naturally infected with a large avian trypanosome. It would thus seem that this fowl trypanosome does not undergo development in *G. palpalis*.

*Experiment* 2276.

| Date | Day of experiment | Procedure | Result | Remarks |
|---|---|---|---|---|
| 1910 March 7 –12 | 1—5 | Flies fed on Fowl 2087 | .. | 200 laboratory-bred flies used. Fowl, Experiment 2087, has been fed on for 18 days by *T. gambiense*-infected *G. palpalis*. |
| ,, 13 .. | 6 | Flies starved | | |
| ,, 14 to April 16 | 7—40 | Flies fed on Monkey 2344 | – | 116 *G. palpalis* dissected throughout this experiment, between the 23rd and 42nd days after flies' first feed on Fowl 2087. All were negative for flagellates. Monkey 2344 was examined bi-weekly for *T. gambiense* till May 10; no trypanosomes ever seen. Monkey died of broken neck later. |

### Conclusion.

The Uganda fowl cannot act as a reservoir of the virus of sleeping sickness.

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## THREE CASES OF PSEUDO-MUSCULAR HYPERTROPHY IN ONE FAMILY (ILLUSTRATED).

By Lieutenant-Colonel R. H. Castor, I.M.S.

Very many of the nervous diseases seen in Europe are met with in Burma, but the following cases are of more than ordinary interest.

During my tour in the district I came across three remarkable examples of pseudo-hypertrophic paralysis in one family in a small village. It was with great persuasion that I managed to get them to come into headquarters and obtained their history, and had them photographed. When they arrived at the hospital crowds of the townspeople came to see them.

*Etiology.*—This disease is known to occur principally among boys, and there is a tendency to affect more than one male in the same family. In this case there were three boys affected. It is characteristic of pseudo-hypertrophic paralysis to manifest itself in boys. In the other forms of myopathy the sexes are about equally affected. It is supposed to be transmitted through the females. After an exhaustive inquiry I was only able to elicit that the father's great grandfather was the only one attacked in a similar way. The rest of the family tree was apparently perfectly free. The hereditary tendency is the only known etiological factor of the disease. In all three cases the disease commenced in infancy, an essential feature in myopathies.

*Family History.*—The father is 47 years old and the mother 44 years, both healthy. They were

married when the father was 19 years old. They had ten children.

(1) The eldest is a male, aged 25; living and healthy.

(2) The next is a female, aged 21; healthy, married, has one child, healthy.

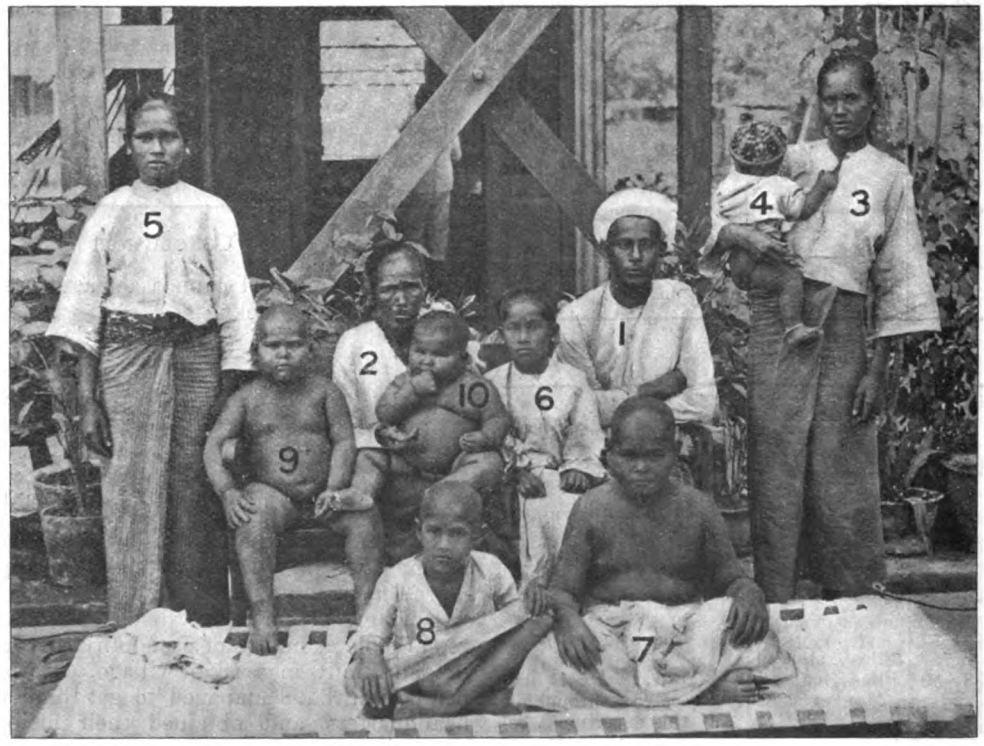
(3) The next one was a female who died when she was 16. This occurred three years ago from fever.

(4) The fourth is a female, aged 14, quite healthy.

(5) The fifth is the eldest boy, afflicted with the disease; he is now 13 years old.

(6) The sixth is a female, aged 9; healthy and living.

(7) The seventh was a male who died when he was 18 months old from convulsions (?), but he was apparently healthy.




1, Father; 2, mother; 3, eldest daughter; 4, her child (1 year old); 5, fourth child; 6, sixth child; 7, first case of hypertrophy; 8, eighth child; 9, second case of hypertrophy; 10, third case of hypertrophy.

(8) The next was a male, aged 7; healthy and living.

(9) This is the *second* boy affected with the disease.

(10) This is the third boy affected with the disease; he is now 17 months old.

The father has four brothers married, all with healthy children, and no sisters. The mother has three brothers, all married, with healthy children. She has one sister married, with healthy children. The parents are practically Burmans, though their ancestors were Mahomedans.

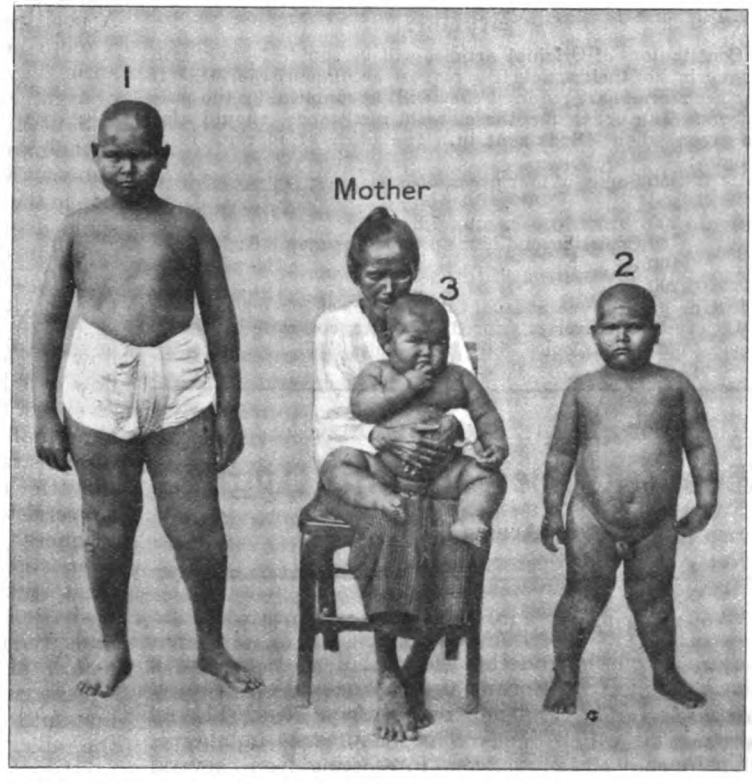
CASE 1.—Maung Pan, aged 13. The father states that when he was 5 or 6 months old he first began getting "large" and this continued till about two years ago, when he was stouter than he is at present.

The muscles chiefly involved were as follows: In the *upper extremity* the deltoid, supra and infra spinati, triceps, extensors of the wrist and serratus magnus. In the *lower extremity* the extensors of the knee, notably the vastus externus, the calves and the gluteus maximus. While of the trunk muscles the erector spinæ was enlarged. There were no signs of atrophy in any of the muscles as yet and all the others were unaltered. The masseters were enlarged and the cheeks were well developed. The muscles of the neck were free. Those of the hands and the feet were intact. The abdomen was prominent. The most characteristic defects noticed were the pronounced lordosis of the lumbar region, the attitude, and gait. There was not much difficulty experienced by the patient in raising himself, either from the recumbent or sitting postures. There were no contractions or distortions. The "loose shoulders" were not apparent, but the shoulder blades were very mobile and presented a "winged appearance." There were no fibrillar tremors, or spasticity of the muscles. The sensory apparatus was not affected. The knee-jerks in this case were practically normal, though perhaps a little exaggerated. There was no ankle clonus; the sphincters were intact. The muscles were hard and firm, but on deep pressure they were painful. The superficial reflexes were present. The heart was normal, pulse 74. The teeth normal, the tongue was furred and not enlarged as is sometimes the case. The appetite was good. Bowels regular. The lungs were healthy. The spleen and liver were normal. The eyes were small, but vision was good. The external genitals were very poorly developed,

in fact the penis, scrotum and testicles were quite small for a boy of his age, and equalled the appearance usually seen in infants of about 2 years old. There were two vaccination marks on the left arm which were well raised above the skin and keloid in character. He had several whitish scars on his legs which were suspicious of yaws, as his youngest brother was suffering from the disease. His chest measured 30 in., waist 36 in., thigh (right) 22 in., and calf (right) 16 in. His weight was 127 lb.

Case 2.—Maung Shwe Ban, aged 5. The history of this case is very similar to the one mentioned above. The father states he first noticed an enlargement in the muscles when the boy was between 5 and 6 months old. The muscles affected were practically the same, but they were comparatively more enlarged. The masseters were more prominent and so were the cheeks. The abdomen was also more prominent. Lordosis was very marked. The attitude and gait were very characteristic and he had more difficulty in raising himself to the erect posture. The knee-jerks were slightly exaggerated. He also complained of pain in the muscles on deep pressure. He was suffering from pyorrhœa alveolaris. The tongue was slightly enlarged and furred. The vaccination marks were distinctly keloid in character. The external genitals were poorly developed, but not so small comparatively speaking as those of his brother. He also had several suspicious scars on both his legs due to yaws. The chest measured 24 in., waist 29 in., thighs 16 in., and calf 10½ in. His weight was 65 lb.

Case 3.—Maung Po Ti, aged 1 year and 5 months. In this case also the parents stated definitely that they noticed the first signs of enlargement of the muscles when the child was between 5 and 6 months old. It will be seen from the photograph that the muscles involved are in proportion much larger than they are in the two previous cases, showing that the symptoms must have developed in the very early months of infancy. The abnormal growth of fat is very marked. In other points the history is similar to the cases quoted above. The patient is unable to walk, or stand for more than a few minutes. The patient is suffering from blepharitis, bronchitis and yaws. There were many yaws ulcers seen on the legs and buttocks, which apparently accounts for the slight constitutional disturbance present. The voice is husky. The condition of the other organs is normal. The testicles are not fully descended and the penis is rudimentary. The patient is very irritable but there is no mental deficiency. The chest measured 20 in., the abdomen, which is very prominent, measured 26¼ in., thigh 15 in., and calf 9½ in. The weight was 35 lb.




1, Fifth child; first case of hypertrophy. 2, ninth child; second case of hypertrophy; 3. tenth child; third case of hypertrophy.

### Remarks.

(1) The poorly developed external genital organs were noticed in all the cases, especially in the eldest boy. This condition I have not seen referred to in any of the text-books I was able to consult, of which the chief were Osler, Risien Russell, and Still.

(2) The knee-jerks, especially in the second case, were slightly exaggerated. The superficial reflexes in all were normal and so were the sensory functions and sphincters.

(3) Pain on deep pressure was complained of in all the cases.

(4) The keloid character of the vaccination marks is a point to be noticed.

(5) It will be noticed that the fifth, ninth, and tenth children were affected. The father positively states that the other children, except the sixth and eighth, also showed signs of enlargement of their muscles when they were young, but this disappeared in two years. His statements were so indefinite that I did not place any reliance on them.

(6) The existence of yaws is not difficult to explain, as yaws is prevalent in this district in several of the villages.

(7) None of the cases were mentally deficient, neither was there any indication of stammering of speech.

(8) The slow progress of the disease is specially seen in the eldest boy.

(9) I regret I was unable to test the electric reactions of the muscles owing to the want of the apparatus.

(10) The other points are brought out in the photographs, which also shows how healthy the other children were.

(11) My thanks are due to Sub-Assistant Surgeons Pillay and Mazundur for helping me in obtaining the history of these cases.

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# Tropical Medicine and Hygiene

APRIL 1, 1911.


## YELLOW SANTONIN IN SPRUE.

THE discussion on the use of Yellow Santonin in the treatment of Sprue, at the Society of Tropical Medicine and Hygiene, on March 17, 1911, an abstract of which appears in the present number of the Journal elsewhere, was interesting from several points of view. Dr. Preston Maxwell, from experiences gained in China, in his opening address on the subject, attributed considerable benefit to the administration of santonin in this disease; and Dr. Charles Begg, from experiences gained in Hankow, China, and in England, expressed a similar opinion. In fact, Dr. Begg was the originator of the use of this drug in sprue. Several authorities upon the subject, however, stated that they had tried santonin for many years, and had noticed no improvement in their patients that could be directly traceable to the administration of yellow santonin. This diversity of opinion as regards the treatment of sprue leaves us pretty well in the same position as we were in before the discussion took place—viz., one of uncertainty, not only in regard to the drug to be used but in regard to the kind of diet to be employed. Moreover, the very nature of the disease, even the actual signs and symptoms which are supposed to establish the presence of sprue, were called in question as to their diagnostic value. The uncertainty prevailing in sprue is in consonance with our knowledge concerning most intestinal ailments, and will remain so until the physiological and pathological mysteries which shroud the portion of the economy known to be involved are unravelled. Until that long-looked-for consummation is reached we must be content to proceed to treat intestinal ailments by the empiric methods adopted from time immemorial. It must be conceded, however, that by empiric methods we sometimes acquire fairly reliable methods of treatment, as witnessed in the cases of malaria and syphilis; so that we need not altogether fold our hands and wait until either the physiologist or pathologist unfolds the exact scientific line to be pursued. A positive statement always carries more weight than a mere negation, and those who uphold santonin in sprue have the better of the position from the point of argument, be it logical or not.

Santonin is admitted in the Pharmacopœia as an anthelmintic; how it accomplishes its end is not exactly known. We know that even a small dose causes alteration in the colour of the urine, brings about yellow vision, some degree of intoxication, and, at times, untoward symptoms to a degree that may even lead to alarming conditions; but any poisonous results are probably due to impurities. Given, dissolved in almond oil or with castor oil, or followed by a few grains of calomel, the flow of bile may be additionally induced thereby. The flow of bile may be an active factor in the treatment of sprue, for not only is the liver in this disease found abnormally small, but the secretion of bile well-nigh disappears. One line of treatment of sprue, namely the "meat treatment," in place of the milk *régime* so persistently adhered to by the majority of practitioners, is given with the idea of developing the liver and its functions. But the originator of the meat treatment of sprue finds medical men as hesitating in the acceptance of his idea as Dr. Begg finds them dubious about the benefits of santonin, yellow or otherwise; in fact, every one temporizes when treating sprue cases, and regards each case as a law unto itself. This policy may be right, for neither the milk, the meat, nor the santonin, nor any of these combined, give us a line of treatment found on other than empiric lines, and not upon any specific basis which can be accepted as a solution of the problem. It is well, however, we should have had the santonin treatment brought forward afresh, and no doubt many practitioners will be inclined to try again a line of treatment which many of them had given up as useless.

### "The Journal of the American Medical Association," March 11, 1911.

Wade, of Chicago, reports a case of enteritis due to the *Trichocephalus dispar* (*Trichuris trichiura*). In addition to the enteritis the patient also suffered from anæmia and eosinophilia. An examination of the fæces showed many of the typical eggs of the parasite. After treatment with thymol ova completely disappeared from the stools, but there is no note as to whether any of the adult worms were passed or not. The enteritis seems to have disappeared and the anæmia improved under iron, arsenic and strychnine.

# Reports.

## REPORT OF SIX MONTHS' WORK OF THE EXPEDITION TO BAGDAD ON THE SUBJECT OF ORIENTAL SORE.[1]

By C. M. Wenyon, M.B., B.Sc.

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Bagdad was reached in the second week in March 1910, and work was commenced as soon as suitable accommodation had been secured. There has been no lack of material, as it was soon found that the Oriental sore of Bagdad, known locally as the date boil, was a disease from which practically all inhabitants suffered at some period of their life. The vast majority of those infected, however, are very young children of from 1 to 3 years, and some time elapsed before a case suitable for the conduction of experimental work was found. The investigations so far conducted may best be described under the following headings :—

(1) The characters and course of the disease in man.

(2) The examination of lower animals for signs of the disease and inoculation of these from man.

(3) Study of the various biting flies, ticks, &c., found in Bagdad.

(4) Experiments with the biting flies fed on date boil cases and dissection of flies.

(5) Examination of the date boil parasite as it occurs in the sore.

(6) Culture experiments with the date boil parasite.

### (1) The Characters and Course of the Disease in Man.

As has just been mentioned, with very few exceptions all inhabitants are infected at some period of their life. Natives of Bagdad almost invariably contract the "date boil" when young, and between the ages of 1 and 3. Newcomers from uninfected districts contract the disease most usually within the first twelve months after arrival, but in rare cases they may escape the disease for years, if not permanently. All classes of inhabitants are infected alike, and the scar left by the "date boil" and known as the "date mark" is to be seen on the face of nearly everyone. People living outside Bagdad—the Arabs in encampments and the dwellers in the smaller villages—apparently escape infection, as several cases have been encountered in young adolescents who have come into Bagdad later in life to find occupations.

*Seasonal Prevalence of the Disease.*—As is generally known, there is a seasonal prevalence of the disease. The "date boil" most usually makes it appearance in the autumn at the time when the dates are ripening. From this fact the name "date boil" is derived, and also one of the local theories which attributes the disease to eating dates or even to pricking by the thorns of the date palms. Such a theory cannot be entertained, since the subjects most usually infected are little children who have hardly attained the age of eating dates. Though the disease most usually makes its appearance in the months of September, October, and November, the "date boil" may develop at any season of the year. This seasonal variation in the frequency of onset of the disease must certainly depend on a parallel variation in the occurrence of some biting fly responsible for its transmission.

*Position of Date Boil on the Body.*—It has long been a recognized fact that the date boil appears only on exposed surfaces of the body. In very young children of about 1 year old one rarely sees a date boil except on the face. This is probably dependent upon the habit of wrapping up infants so that the whole body is covered except the face. In children a little older the date boil is commonly seen on the arms and legs below the elbows and knees, though the face is still the most usual situation. In adults, invariably newcomers, the disease appears almost as frequently on the arms and legs as upon the face. It is rare to find a date boil in any other part of the body. I have seen one case in a boy aged about 5, where there was one boil on the buttock and another on the chest over the sternal end of the second left rib. This practically constant appearance of the date boil on the exposed surfaces of the body can only be explained by the assumption that the disease is transmitted by some biting insect which feeds upon these exposed surfaces, in contradistinction to such biting insects as body lice, fleas, and bed bugs, which prefer to suck their blood under the protection of clothing.

*Number of Date Boils.*—It is probably safe to state that the single sore is most commonly encountered, and this one may be on the cheek, lip, nose, eyelid, forehead, arm, hand, leg, or foot. Two, three, and even four sores are by no means uncommon, but cases with larger numbers than these are certainly rare. I have seen one case where there were eighteen sores on the face, and one on each of the limbs, with the exception of the left arm, which had two, making a total of twenty-three sores. I have been told of cases where the numbers have been even greater, but the character of the sores in these cases had not been established by microscopical examination. The question may be asked: "Is it safe to assume that, in these cases of multiple sore, each sore is the result of a separate inoculation by some biting insect?" It may be answered that in this case of multiple infection there was not a single sore on an unexposed surface.

*Incubation Period.*—On the subject of the incubation period it is difficult to obtain precise information. The youngest child I have seen infected was aged 7 months. Cases of Europeans becoming infected within two months of entering the country are not uncommon, and I have obtained a reliable history of a case of two red spots appearing on the feet a fortnight after arrival. These persisted for upwards of a year, and in them I was able to find large numbers of the typical parasites. On the other hand, it is known that the disease may make its first appearance in a person many months after leaving the country. It is probable that the time elapsing between inoculation and the appearance of a visible sore is very variable, and may depend on several factors, such as a person's

[1] From the *Report of the Advisory Committee for the Tropical Disease Research Fund for* 1910, with some verbal emendations by the Author.

natural resistance to the disease and his general health at the moment of infection. The parasites may have been multiplying slowly in the skin at the point of inoculation, and have produced no visible reaction, or one which is so slight as to be overlooked. It is difficult to fix a point up to which the period of incubation is to be reckoned.

Recently, I have attempted inoculation in human beings, but these experiments are not yet complete.

*Character of the Sore.*—Locally it is believed that there occur two kinds of sore, which are designated male and female. Clinically this is true. As the types of two extremes there exist the ulcerating and the non-ulcerating sores. The ulcerating or, as it is known locally, the female sore, commences as a red papule, the surface of which soon breaks down, leaving a shallow indolent ulcer from which a yellow fluid exudes carrying with it the typical date boil parasites and the numerous bacteria with which these ulcers become secondarily infected. The ulcer gradually extends till in very severe cases a large area may be involved. In one case encountered the ulcer occupied the whole of one cheek, had destroyed the lower eyelid of that side, and had extended across the bridge of the nose to the other cheek. When small, these ulcers frequently scab over, but the scab is easily removed, and when left only serves to retain pus, and to make the sore painful. In these spreading sores one often finds that one part of the sore heals while it is still extending in another direction. When these ulcers heal they leave the superficial large scars known as the "date mark," seen so commonly on the faces of the Bagdad inhabitants. It is very rarely that any deformity results from contraction of these superficial scars.

The male, a non-ulcerating sore, commences also as a papule of a characteristic reddish-brown colour, and covered with shiny epidermis. It increases in size very slowly, and shows very little or no sign of ulceration. A scaly scab may form at the centre of the date boil. This scab may fall off naturally or be removed, when there is again left the reddish-brown shiny skin beneath. On puncturing such a date boil one obtains a pure culture of the date boil parasite free from any admixture with other organisms. It is from such sores that the cultures to be described below have been obtained. At any time the centre of one of these non-ulcerating sores may break down and give rise to an ulcer, which may become secondarily infected and extend as the female sore.

*Duration of Disease.*—The duration of the disease is usually about one year, with a variation of about three months on either side of this limit. The sore may remain as in the "male sores" without ulceration at any stage of its existence. It remains a papule which increases in size, becomes stationary, and finally shrinks till it completely disappears, leaving a reddish-brown coloration of the skin which gradually fades away. The scars left by these sores are never so deep as those of the ulcerating type, where infection with other organisms is a constant feature of the disease. The organisms found in the ulcerating sores are streptococci, staphylococci, various bacilli, and frequently a diplococcus resembling very closely the gonococcus, in that it occurs in pairs within the pus cells. This latter organism I have found on several occasions in a subacute ulcer which frequently attacks people in Bagdad, and which might readily be confused with the true date boil. It is worth while remarking that on no occasion have I encountered spirochætes in the scrapings of these ulcerating date marks.

*Immunity.*—After the date boil has healed, the person is protected completely from further attacks. I have been told of persons who have had a second, and even a third, attack, but if such cases occur they must be extremely rare. The consensus of opinion amongst the inhabitants of Bagdad is that a second attack is impossible, and the exceptions are so few that this opinion is substantially correct. Sometimes while a date boil is developing on one part of the body a second will begin at some other point perhaps six months after the commencement of the first. This merely shows that the immunity is not yet complete. In one case an Englishman suffered from a sore on the right wrist for about one year. It disappeared when a second sore developed on the left elbow, and this lasted for another year. Some cases have been recorded of persons who have suffered from the Aleppo boil contracting the Bagdad boil on coming to this town. With these few exceptions the single attack lasting about one year is the rule, while the healing of the sore appears to be brought about by an immunity against the specific organism acquired by the person infected, such an immunity being of sufficient duration to protect the person from further attack for the rest of his life.

*Treatment.*—It is very doubtful if any treatment at present attempted has been of avail. Excision of the sore has been attempted and with success, but such a procedure would probably leave the patient non-immune and open to further attacks. Various ointments and lotions have a certain reputation in Bagdad, but they do little or nothing to lessen the duration of the disease. I have been giving the yellow mercury ointment of the B.P., and some have declared it to have produced a cure in a few days. The majority of the people are very dirty, and as I insisted that before the application of a fresh supply of ointment to the sore, the old ointment must be carefully washed off, this treatment at least has had the virtue of keeping the sores clean, and in this way alone may have been of benefit.

*Symptoms.*—Apart from purely local symptoms due to the sore it is impossible to trace any constitutional disturbance. The fact that nearly all sores are in very young children makes the selection of such symptoms difficult, as any slight disturbance in health can at this age be attributed to the common ailments of childhood. Again, the onset of the disease is so insidious that the appearance of the first papule is not considered to be a date boil, till by its persistence the patient recognizes its nature. Slight fever, feeling of malaise or intestinal derangement, which might be due to the infection with the organism of the date boil, would most probably be looked upon as one of those slight disturbances so common in all hot countries. In the case mentioned above, of the child with twenty-three sores, there was nothing to indicate, apart from the sores, that the child was

in any way abnormal. The child was well developed and well nourished, and showed every sign of enjoying life completely. It has been suggested that this disease is a general one, and that the sore is merely a local manifestation of a general infection, as in the case of the syphilitic chancre. If this be true there is, however, this difference: whereas the chancre in syphilis indicates a very severe general infection accompanied by various symptoms, the date boil is accompanied by no such constitutional disturbances or such as are too slight to be detected.

The impossibility of performing autopsies in Bagdad is a misfortune, as from this source much light may be thrown upon the disease. Repeated examinations of the blood of infected persons have failed to confirm the observation of Neumann that parasites may occasionally be found in the peripheral blood. Likewise the attempts made to obtain cultures from the peripheral blood have met with no success. These observations and experiments might be continued however.

The local symptoms are due to the presence of the sore. As a rule there is little accompanying pain, and the sores are not remarkably tender. Occasionally where the sore has formed over a bone, as the tibia or on the elbow, the sores are tender and painful, but this is the exception. The discharge from the ulcerating sores is often very foul and exceedingly unpleasant, not only for others, but for the patient himself, who frequently is unable to remain in a room, but has to seek refuge in the open air. The painlessness of the date boil is well illustrated by the case of a man who had two on the foot for about one year. In spite of the sores he was able to wear his ordinary footwear, to walk, ride, and take other forms of exercise without inconvenience.

I am unable to give any information as to the occurrence or otherwise of kala-azar in Bagdad. The staff of the English medical mission at Bagdad have not met with the disease. If the disease occurs it has not yet been diagnosed as such. I have seen several cases with enlarged spleens and livers apparently not malarial. It is possible that some of these may have been kala-azar, but a blood examination alone did not throw any light on the condition.

(2) Examination of Lower Animals for Signs of the Disease and Inoculation of these from Man.

*Dogs.*—The commonest domestic animal living in close association with man in Bagdad is the dog, which lives upon the refuse of the houses thrown out upon the streets. There is a general opinion that the dogs suffer from the date boil about the nose. Cases of dogs with these supposed sores on the nose have been difficult to find, and were not nearly so common as they were supposed to be. Several cases were, however, discovered, but unfortunately in none of these could the parasite be found. One large dog had an ulcerating condition of the legs which had been regarded as date boil, but repeated examinations of this have failed to reveal the parasite. All these cases were in pet dogs living in private houses. Examination of a large number of street dogs has shown that ulceration about the nose is very uncommon amongst them, though they often have wounds on the head, the result of their constant fighting.

Quite recently the authorities in Bagdad have followed the example of Constantinople in taking steps to exterminate the dogs from the streets. Accordingly all street dogs have been collected and herded together in an enclosure in the desert, where they are kept in a condition even less sanitary than that in which they lived before. These dogs died off rapidly, and I obtained permission to perform autopsies on them. Up to the present I have examined the organs of about eighty dogs, and at the same time have kept a careful look-out for any sign of date boil. I have not been able to find the parasite of the date boil in a single instance, so that if the dog acts as an alternative host for this parasite, it is only a very small percentage of dogs that is infected. Further, if it be true that the dog acts as a kind of reservoir for the parasite which is handed on to man by some biting fly, then the incidence of date boil amongst the population of Bagdad should considerably diminish now that all the street dogs have been removed. Time alone can give the result of this experiment.

Nearly every dog examined is found to harbour a hæmogregarine in its leucocytes, and the reproducing forms are constantly present in the spleen and bone-marrow.

Piroplasmosis is common, occurring in perhaps 5 per cent. of the dogs.

The dogs are covered with ticks and fleas, and also a fly belonging to the Hippoboscidæ. All of these will draw blood from man, the latter, however, rarely.

*Cats.*—Cats in Bagdad, like the dogs, live in semi-domestic condition. I have not been able to examine more than one of these animals, and the result of this examination was negative.

*Rats.*—Rats are exceedingly common and a great pest. Examination of numbers of these has only revealed the common *Trypanosoma lewisi* and the hæmogregarina occurring in the leucocytes.

Inoculation of numbers of rats with date boil material has given no result.

*Rabbits.*—Similar experiments conducted on rabbits have likewise failed to give any result.

*Birds.*—Sparrows and two small owls have been inoculated without success.

*Ticks.*—An attempt has also been made to obtain a development of the parasite by inoculating the large blown-out ticks taken from dogs. The ticks survived the operation of inoculation, but no trace of any development of the parasites could be found.

Other domestic animals in Bagdad are the horse, mule, donkey, and cattle. Camels are rarely seen in the town, and then only in passing through the town from one gate to another. They are always left without the town in the desert. It is unlikely that any of these animals have any influence on the disease as it occurs in Bagdad.

The failure to obtain an animal suitable for inoculation experiments has proved a great obstacle to the work. With an animal reacting easily to inoculations, as so many animals do to pathogenic trypanosomes, the work would be much simpler, whereas now experi-

ments with flies can only be tested by dissection and search for developmental forms of the date boil parasite, a procedure which is much more difficult and full of pitfalls than the experiment of transmission.

(3) Examination and Dissection of Flies and Ticks.

*Biting Flies.*—Before naming the true biting flies some remarks must be made on the common house fly, which, as would be expected, occurs in myriads. It is constantly swarming over the faces of the children, and especially those made attractive by the presence of the date boil. From an examination of the flies taken off the sores I have demonstrated that the parasites are being continually taken up, and are to be easily found in the gut directly after feeding. It must certainly come about that the house fly acts on occasions as a simple carrier of the disease to open wounds. Only in this way can be explained some of the cases in which wounds incurred upon the face, arm, and leg, have ultimately developed into date boils. Or, as sometimes happens, the wounds completely heal, and later a date boil develops at this spot.

*Stomoxys.*—From the time of my arrival in Bagdad in March, till the hot weather had set in in June, these flies occurred in fair numbers, especially in the neighbourhood of the stables. They often settled upon one and were mistaken for ordinary house flies till the pricking of their proboscis revealed their nature. They would frequently bite through socks. With the advent of the really hot weather these flies almost disappeared, and could rarely be discovered even in the stables, their favourite haunt. These flies feed normally upon the horses, mules and donkeys.

*Hippoboscidæ.*—Flies belonging to this group are to be found commonly on the horses. Another is seen constantly on the dogs, where it hides buried in the fur till disturbed, when it leaves its host or flies to hide on some other part of the body. These flies will sometimes bite human beings, but this is a rare occurrence. I have been bitten only on two occasions, though I have been living in close association with a number of dogs, all of which had many of these flies about them.

*Tabanidæ.*—Flies of this genus, Tabanus, I have not encountered in Bagdad, but I have seen one taken a mile or two out of the town.

*Fleas.*—Fleas are a great pest, and especially at a certain season of the year, which is popularly known as the flea season. The season is the month or two before the commencement of the summer or season of intense heat. They are constantly on one's person, and give one no rest. With the hot weather they completely disappear.

*Body-lice.*—These are found commonly on the bodies and clothes of the dirty part of the population of Bagdad.

*Ticks.*—Ticks are found on practically all the domestic animals. They, however, rarely attack man. The dogs in the streets are usually covered with them.

*Bed-bugs.*—Bed-bugs occur in Bagdad, but in no great numbers. They can usually be obtained fairly easily in the prison, where they hide in the mats used to cover the floor, or upon which the prisoners sleep. In only one other house have I heard of the occurrence of bed bugs, and then only in small numbers. It is certain that Bagdad is not infected with bed bugs to anything like the extent of some other Eastern cities. It is possible that the dryness of the atmosphere, combined with the intense heat, is unfavourable to their development.

*Sand-flies.*—Sand-fly is a name used here for any small fly that bites at night. I have not encountered a true sand-fly in Bagdad. The fly usually described by this name is a Phlebotomus. It is able to pass through the meshes of the mosquito net, from which it escapes in the morning after feeding. I have only been able to secure very few of these flies, as they are exceedingly difficult to capture.

*Mosquitoes.*—These occur in large numbers. In those years that the river overflows its banks and runs into the desert around Bagdad, forming pools and marshes, the mosquitoes are said to occur in greater numbers than I have seen. Before the hot weather has set in, from March to June, various species of *Culex* were very common. Amongst these was the common *Culex fatigans*. The other species have not yet been identified. With the advent of the hot season the number of *Culex* began to diminish, while another mosquito, *Stegomyia* sp., increased in numbers. This mosquito lives in the houses and hides in any dark corner, especially the sirdarbs, or semi-underground rooms, into which one retires at the hottest part of the day. The Stegomyia is most persistent in its attack, and is a constant worry during the day Both the male and the female suck blood, but the females more vigorously. A female mosquito will readily feed every day, and forty-eight hours appears sufficient time for the digestion of the large quantity of blood taken at a single feed. During the hot weather these mosquitoes increase in numbers, till at the end of September they are at their maximum. They breed, as do other mosquitoes, in the wells and "hubs" or native filters of porous earthenware found in every house in Bagdad. During the hot weather the growth is very rapid, and one week is almost sufficient for the complete development of the mosquito from the egg.

*Dissection of, and Experiments with, Flies, Ticks, &c.*—The ordinary house-fly commonly harbours the flagellate Herpetomonas in its gut. It is difficult to give any definite percentage for infected flies, as the number of infected individuals in different batches varies considerably. It is possible that more than one species of Herpetomonas is to be found in the house-fly. A Crithidia was found on several occasions to inhabit the Malpighian tubes. As mentioned above, these flies constantly feed on the date boils, and the parasites can be demonstrated in the gut soon after feeding. So soon as six hours after feeding on the sore I have failed to detect the parasite in the gut. A large number of experiments have been conducted to trace any development of the date boil parasite in the fly's gut, but without success. Two series of flies, consisting of ten each, were fed in the following way;—

One series was allowed a daily feed of fresh human blood, the second series was fed on the scrapings of a date boil. After ten feeds in this manner the flies were dissected. The result was that in those that had fed from the sore no trace of the date boil parasite

or other flagellates could be detected, while amongst those that had fed upon human blood one had a Herpetomonas, probably *H. musca domestica*, in its gut. From this and other experiments it appears that the date boil parasite does not develop in the house-fly. I have not been able to determine whether the parasite is passed unharmed through the gut of the fly. Examinations of the excreta have given no definite result.

Stomoxys feed readily off the sore each day but the results of such feeds have been negative. This fly occasionally harbours a Herpetomonas, evidently a parasite peculiar to itself.

Large numbers of the dog-fly (Hippoboscidæ) have been dissected, but no flagellates were found in them. It was impossible to keep these flies in captivity, nor could they be induced to feed from the date boil. A dissection of the fleas and body lice have likewise given no result in the way of a flagellate infection.

With bed bugs obtained from the prison experiments were made. The bugs were allowed to feed upon the sore, and were dissected at varying intervals after feeding as had been done in all feeding experiments. In a certain number of these, flagellates of the Herpetomonas type were found in the gut forty-eight hours after feeding.

The resemblance of these flagellates to the cultural forms of the date boil parasite is very close, and since a dissection of a considerable number of bugs, which had not fed on the sore, has failed to reveal any flagellate infection, it is probable that this Herpetomonas represents a culture of the date boil parasite in the gut of the bed bug. The distribution of the bed bug in Bagdad is so restricted that it is impossible for it to be the true carrier of the date boil. It is more probable that the large quantity of blood taken into the stomach had served as a good culture medium in which the date boil parasites were able to develop.

This observation is very similar to that by Patton on the development of the parasite of kala azar in the same insect. If the parasite of the date boil can develop into a flagellate in the stomach of an insect, not its true host, then it would be expected that the very similar parasite of kala azar would develop in the same manner. Such experiments and results only show that it is unsafe to draw the conclusion that an insect showing such developmental stages is the true carrier of the disease. The development is probably merely a partial imitation of what would actually take place in the true intermediate host.

A large number of experiments have been conducted with mosquitoes, which in nearly every instance have been hatched in the laboratory. With the various species of *Culex* there was no result. It was exceedingly difficult to induce them to feed upon the sore, and it was only rarely that one would feed more than twice. However, a sufficient number were experimented with to show that no development of the date boil parasite was to be traced in them. With Stegomyia the feeding was much simpler. They fed readily in broad daylight, and were eager to feed upon the sore every day. It was determined that these mosquitoes had taken up parasites by dissections made immediately after feeding. These mosquitoes were allowed a varying number of feeds, and dissected as a rule twenty-four or forty-eight hours after the last feed. A large number of experiments have been conducted, and in four instances Herpetomonas have been found in the mid-gut. These bear a close resemblance, as in the case of the bed bugs, to the cultural forms of the date boil parasites. The hind gut was in every case free from flagellates, and this fact is perhaps in favour of these flagellates being derived from the parasites taken up at the feeds, for as a rule an insect having a natural flagellate infection has the infection limited entirely or most marked in the hind gut. It is very difficult to obtain a definite proof that these flagellates have developed from the date boil parasites. Up to the present Stegomyia fed on human blood free from parasites have failed to reveal any flagellates on dissection. The examination is still in progress.

All these feeding experiments have been conducted upon a case of date boil in a boy. The sore was of the non-ulcerating type, and covered with thin red skin. Puncture of the sore gave a pure culture of the specific parasite free from any other organisms.

Very commonly a Gregarine is to be found, in the encysted and spore stage, within the Malpighian tubes of the Stegomyia. The complete life-cycle of this Gregarine has been traced. The free Gregarines live in the intestine of the larvæ, where they are seen hanging from the endothelial cells. As the larva changes to the pupa so the Gregarines migrate into the Malpighian tubes, and commence encystment in pairs. By the time that the mosquito emerges from the pupa the complete development has taken place, and the characteristic spindle spores are to be found in the Malpighian tubes. Evidently these spores escape into the water and re-infect the young larvæ with their food.

Occasionally the larvæ of *Stegomyia* sp. have an infection of Herpetomonas in the Malpighian tubes. It is possible that the flagellates found in the mid-gut of the adult mosquito after feeding on the date boil are derived from these. However, no case of flagellate infection of the pupa has yet been met with, though very many have been dissected.

The gut of the larvæ is almost always teeming with Spirochætes.

Unfortunately, up to the present it has been impossible to secure sufficient specimens of Phlebotomus for experimental work.

*Character of the Parasite as found in the Sore.*—The parasite in smears from the sore varies very much in size and shape from the classic oval parasite with the deeply-staining rod and paler nucleus. The typical oval parasites are found in large numbers, but in addition to these are many smaller forms occurring mostly outside the cells. As Dr. Row has figured them they are frequently pointed at one end, while the micronucleus lies close against the macronucleus. In the pointed forms the micronucleus is almost invariably on the side away from the pointed extremity, a fact which seems to indicate that this pointing is not a stage in the direction of flagellum formation as one is inclined to suppose. The protoplasm of the body of the parasite is usually vacuolated, while the fine red staining line running from the micronucleus to the surface of the body is often seen, especially in

the larger forms. This red line is without doubt the rhizoplast, root, or intra-protoplasmic part of the flagellum. I have not been able to trace any change undergone by the parasite with the growth of the sore. All forms are to be found in both young and old sores. Parasites without nuclei, or with only a micronucleus or macronucleus, are frequently seen. These are probably degeneration forms. The case of admixture with other organisms in the ulcerating sores has been mentioned above. As is well known, the parasites, when intracellular, are found in the large mononuclear cells which are often full of parasites, and have their nuclei broken up by this invasion. When other organisms are present, and there is a purulent discharge, the parasites are taken up by the polymorphonuclear leucocytes.

*Culture of the Parasite.*—The parasite has been successfully cultivated on several occasions. The first attempt was made with a medium prepared after the formula of the rabbit blood agar of Novy and MacNeal, with the difference that dog's blood was substituted for the rabbit's blood. After several failures, due to contamination, a successful result was obtained from a boil on a child's face. Sub-cultures were made from this upon rabbit blood agar and dog blood agar. Development in the rabbit blood medium was much more rapid, and on this the culture was maintained for several months. The cultures upon the dog's blood medium eventually died out. The development of the parasite followed closely the description given by Dr. Row of the cultures of the parasite of Oriental sore.

Inoculation of these cultures into various animals has given no results. The parasites, both in smears of the sore and from cultures, have been stained by various methods. Giemsa's method of wet fixing and staining has been tried, and films have been fixed in Schaudinn's fixative and stained with Heidenhain's hæmatoxylin, and also with ordinary alum hæmatoxylin. Both in the parasites from the sore and from the cultures the nucleus was found to have a structure very different from that appearing on films stained by the drying methods. The nucleus consisted of a spherical or oblong body limited by a delicate membrane. At the centre of this is a deeply-staining karyosome appearing red by Giemsa's method and black after Heidenhain's hæmatoxylin. The nucleus of this parasite is, therefore, constructed on the same lines as the nuclei of the trypanosomes. In nuclear division the karyosome first divides by becoming elongated and finally constricted at the centre; the micro-nucleus stained as a round or rod-shaped body surrounded by a pale area. The flagellum in the flagellated forms was traceable to a point close to the micronucleus, but it does not unite with it.

In multiplication by division the flagellum of the divided-off parasite appears to be a new formation growing out from the micronucleus, and is not formed by splitting of the already existing one.

*Origin of the Disease.*—There are many local theories explaining the origin of the disease. Some maintain that it is only those who drink the water of the Tigris or Euphrates who become infected, others that it is due to the contamination of open sores by dust from the roads, while some believe it to have some kind of relationship to syphilis. The names "date boil" and "date mark" are the result of another theory attributing the disease to the dates which become ripe just at the season of maximum incidence of the disease. None of these theories will explain the disease. On account of the peculiar distribution of the sore, the character of its parasites, and the development of this into Herpetomonas in the culture tube, the only tenable hypothesis is that some biting fly transmits the infection. The possibility of the house-fly acting as a mechanical carrier of the disease has been mentioned above. That this mechanical transmission is to be regarded as the normal means of infection cannot be maintained. That it can act in any other way than a mechanical carrier is disproved by the failure of the parasites of the date boil to develop into flagellates in their intestines, and the quick disappearance of these when taken up from the sore. These statements are, of course, based on the assumption that the culture one obtains in the test-tube is at least a picture of what is to be found in the intestine of the true intermediate host. That this is probably correct is borne out by the fact that a partial development will take place in the intestine of the bed bug.

The Stomoxys as the carrier of the disease is not to be suspected, as it not only is limited in its distribution, occurring, as already stated, mostly in the neighbourhood of the stables, but it also fails to give any development of the parasite in its gut even after as many as ten feeds from the sore.

The bed-bug, on account of the development of the kala-azar parasite taking place in its gut, and its supposed responsibility for the spread of this disease, was at first looked upon with suspicion. It was soon found that its distribution in Bagdad was too limited to account for the disease; and further, it would not explain the occurrence of sores only upon exposed surfaces of the body. In spite of the impossibility of the bed bug being the host of the date boil parasite a certain development of the parasite takes place in its gut. This observation is of great importance, as it shows that the development of the kala azar parasite, which was found by Patton to take place in the same host, may be of a similar nature. The evidence of such a development is insufficient to prove the bed bug the intermediate host. There is a possibility, in my experiments as well as in Patton's, that the flagellates seen in the bed-bugs are parasites peculiar to these insects. A dissection of numbers of bed-bugs which have not taken up date boil parasites has at least tended to disprove this view. It seems, therefore, that the large quantity of blood taken up by these insects when they bite is able to act as a culture medium for these parasites, without this culture indicating in any way that the development is the true development in an intermediate host.

The Hippoboscidæ, the ticks, the fleas and body-lice will not explain matters. The two former on account of their seldom attacking man, and the two latter because they would give rise to sores more frequently on the unexposed rather than on the exposed surfaces of the body.

The only other biting flies of any note in Bagdad are the mosquitoes and the so-called sand-flies. Of

the mosquitoes only the Stegomyia can be suspected. In the various species of *Culex* no demonstrable development of the parasites has taken place. On the other hand various facts would point to the Stegomyia. This mosquito is essentially a house mosquito, and is most persistent in its attempts to obtain a feed of human blood. When it has completed its fill of human blood it quickly digests this apparently enormous quantity, and is ready on the next day for another feed. It bites as readily by day as by night, so that one is never free from its attacks. Further, with the commencement of the hot weather this mosquito increases in numbers till at the end of September it is at its maximum. This corresponds with the season of maximum prevalence of the date boil, which, as before mentioned, is in the month of October. In addition to this evidence, in a certain number of these mosquitoes fed from the date boil flagellates have been found in the stomach forty-eight hours after feeding. It is not quite certain that these represent developmental stages of the date boil parasite, and even if they do their numbers and character resemble the condition found in the bed-bug, and is not the extensive development one would like to find. However, experiments of transmission with this mosquito have been done upon a resident in Bagdad who has not yet suffered from the date boil. It is still too early for any result. It would thus appear that there are many points in favour of regarding the *Stegomyia* sp. as the transmitter of this disease, and if it were not for the presence of the sand-fly (Phlebotomus) the evidence would be still greater. This small fly attacks during the summer months, but has not been secured in numbers sufficient for experimental work. It bites especially on the roof at nights, where all Bagdad inhabitants sleep during the hottest weather. I am unable to give any facts in support of this fly being the host. It has been suspected in other places where this disease occurs. In Bagdad, however, in numbers and ferocity it does not approach the Stegomyia. This, however, is no evidence for or against its accusation.

## THE SOCIETY OF TROPICAL MEDICINE AND HYGIENE, MARCH 17, 1911.

A PAPER was read for Richard P. Strong, M.D. (Director of the Biological Laboratory, Bureau of Science, Manila; Chief of the Department of Tropical Medicine, Philippine Medical School and Hospital), on "The Specific Cure of Yaws by Dioxydiamido-arsenobenzol."

This work which has also been read before the Manila Medical Society, and published in the *Philippine Journal of Science* (October, 1910, vol. v., No. 4) has already been dealt with fully in THE JOURNAL OF TROPICAL MEDICINE AND HYGIENE (February 15, 1911), Castellani's similar experiences also being noted in the same number. Strong in his present paper draws attention to the fact that the cure of yaws by "606" and the successful results which have been obtained with the same drug in the treatment of certain cases of syphilis may suggest again the identity of yaws and syphilis. He considers that it does not appear strange that this preparation should have such a destructive action against both *Treponema pertenuis* and *Treponema pallidum*, since both from a morphological and biological standpoint these two organisms appear closely related. Potassium iodide, indeed, which is so valuable in the treatment of syphilis, has hitherto been the most successful remedy employed in the treatment of yaws. The therapeutic argument for the identity of yaws and syphilis, and hence for the identity of their specific organisms, is, as Strong shows, very fallacious. Many instances in medicine, he states, might be quoted in support of this statement. Quinine, which destroys certain forms of *Plasmodium malariæ*, *Plasmodium vivax*, and *Laverania malariæ*, also, for example, destroys *Amœba dysenteriæ*.

While Strong's experiments on treatment were in progress, articles by Nichols were published on the successful transmission of the spirochætæ of yaws to the rabbit's testicle (*Journal of Experimental Medicine*, September, 1910), and on the cure by injections with dioxydiamidoarsenobenzol of the experimentally produced lesions in four of these animals and in three monkeys moderately infected with yaws (*Journal of the American Medical Association*, July 16, 1910).

Dr. J. Preston Maxwell then read a paper on "The Use of Santonin in the Treatment of Intestinal Affections of the Tropics." In opening his paper he stated that he would exclude from the discussion its action as a vermifuge or vermicide.

Santonin ($C_{15}H_{18}O_3$), he said, was a neutral crystalline principle extracted from the unexpanded flower heads of *Artemisia maritima*. Probably, however, it was not truly neutral, but the anhydride of monobasic santonic acid, and its formula $C_{15}H_{20}O_4$.

Its general characteristics were well known and he need not enter into them again. Suffice it to say that we had to deal with two substances, both of which passed under the name of Santonin.

*The first* was ordinary white santonin, which had been tried in the treatment of the affections which were now under discussion and which had been found to be useless or practically so.

*The second* was yellow santonin (chromosantonin of Montemartini). It was prepared by exposing ordinary santonin to prolonged sunlight, and that the yellow colour was not a mere colour change was proved by the following points.

There was no change in weight, but the derivatives were different, the rotatory powers were different, and the colour was different. If the yellow santonin was dissolved in alcohol, however, and repeatedly re-crystallized, it gradually passed back again into the white.

Chromosantonin was more readily oxidized, and the products of oxidization were said by Montemartini to be different. Sestini stated that the white santonin was changed into formic acid, an uncrystallisable substance much more soluble in alcohol and ether than santonin (photo santonic acid $C_{15}H_{22}O_5$) and a red resinous substance.

Both the white and the yellow underwent oxidation in the tissues, and were excreted in the fæces and urine in several forms.

Proceeding, Dr. Maxwell said little was known of

the process of oxidation. Under ordinary circumstances probably little was dissolved in the stomach. It might, however, in rare cases, be so rapidly absorbed as to be useless for the purpose of a vermifuge. The major part of the drug was absorbed from the intestine, and undoubtedly passed into the blood-stream, as in large doses there was a marked influence on the cerebrum. It was certainly excreted by the kidneys, and possibly was re-excreted into the intestine. On the urinary passages it had some irritative action, and it might cause incontinence in children, and clinically in adults it might act as a diuretic.

In large doses vision was markedly affected; first in the direction of bluish vision, followed by yellow vision, wherein everything white appeared to be yellow; then there might be hallucinations of vision and confusion of speech, the sense of taste and smell might be deranged, and in rare instances hearing likewise. As the effect of the drug passed off there might be a period of violet vision.

All these effects might supervene on a medicinal dose.

The preparation of chromosantonin was not an easy matter. To get a really good specimen might need six months of sun in sub-tropical regions, and white santonin with a slight yellow tint was not chromosantonin, though it had to his own knowledge been used as such with consequent disappointment at the failure to get the expected result.

A diversity of opinion seemed to exist as to the value of santonin as a curative agent. Dr. Begg, of Hankow, found by clinical experience that santonin was a cure for certain forms of chronic tropical diarrhœa, the virtue of the drug lying in the chromosantonin, not in the white santonin, which was useless. On the other hand, Sir Patrick Manson after trying the method in a considerable number of cases, stated that his experience had not been favourable. Dr. Maxwell then gave a description of the clinical histories of a series of cases, personal friends of his own or of his father's, in which santonin had been used, and in which there was not a shadow of doubt that the drug had had a curative effect. The first three of these were cases of sprue, the fourth a case of dysentery, the remainder being cases of Dr. Maxwell's own, diarrhœa cases and early sprues seen in China. Good results seem to have been attained, but unfortunately no accounts of cases where the drug had failed were given. Dr. Maxwell further stated that he had never met with a typical case of sprue amongst the Chinese, but had tried the drug pretty extensively in cases of chronic dysentery. Some of these—non-amœbic cases—he believed were cured. He concluded his paper as follows:—

(1) That there were two substances known as santonin: santonin and chromosantonin. The last-named differed completely from santonin as regards its chemical composition, and therefore might be expected to show differences in its physiological action.

(2) That this chromosantonin exerted a marked influence on the development of putrefaction in the bowel.

(3) That it had a specific influence on certain cases at present classified under the wide term "sprue," and in certain cases of chronic dysentery which were not due to the action of the *Amœba coli*.

(4) That the differing reports as to its action were in part due to its not having been properly prepared, and that it was important that in future work care should be given to this point.

(5) That chromosantonin was not to be regarded as a cure-all. Nothing would *cure* a case of sprue or dysentery where there had been destruction of any large area of the intestinal mucous membrane, nor would any drug ensure a patient against possible relapse. On the other hand, it deserved a careful trial in the treatment of intestinal affections, and one hoped that as the result of the discussion this would take place.

An animated discussion then took place on Dr. Maxwell's paper, the general trend of opinion being that santonin was useless as a curative drug in the vast majority of cases of sprue, though in certain obscure intestinal conditions, good did sometimes follow its use.

## Helminthology.

### (a) Original Investigations.

### A REMARKABLE CASE OF SCROTAL INFECTION WITH *FILARIA LOA*.

Dr. ANDREW CONNAL, of the West African Medical Staff, has recently sent to me a tube containing several filariæ, collected by him at a *post mortem* at the Government Hospital, Lagos, S. Nigeria. These filariæ were accompanied by the following brief history: "Patient, aged 23, brought in moribund, advanced cardiac disease, failure of compensation. Died within twenty-four hours of admission. Enorous numbers of embryos in blood. No external signs of filariasis. No elephantiasis. Scrotum had a perfectly normal appearance. When this was opened *post mortem* a diligent search resulted in twenty-one worms. These were easily found and were lying apparently in lymph spaces." (A. Connal).

I find that these worms, which were most beautifully preserved, belong to the species *Filaria loa* without exception. There are in the consignment fifteen males and six females.

In the great majority of cases on record the parasite has been taken from the eye, but its occurrence in this situation seems to be without special significance, for occasionally in horses and in cattle young migrating forms of *Filaria*, whose normal habitat is the peritoneal cavity, appear in a similar position.

Sir Patrick Manson has on several occasions directed attention to the appearance of *F. loa* in various parts of the body, producing what are now known as Calabar swellings. These are transient in character, and do not appear to have attracted the proper amount of attention in the endemic areas as a clinical indication of *loa* infection.

Sir Patrick Manson has been good enough to give me a reference, which would otherwise have escaped

my attention, to another case of multiple infection with *F. loa*, viz., that described by Penel in 1905, from which no less than thirty-four adult *F. loa* were recovered by careful dissection of the body; the worms were found in the limbs, none being present either in the trunk or neck.

In view of the fact that the parasite lives normally in the connective tissues, and has on several occasions been found under the skin in various parts of the body, and that it is known to migrate rapidly from one part to another, one is tempted to think that the occurrence of so many worms in the scrotum in Dr. Connal's case was but a local manifestation of an intense and more generalized infection. This probability is strengthened by the observation, made by Dr. Connal, that there was an enormous infection of the blood with embryos, although of the adult worms actually recovered only six are females.

R. T. Leiper, M.B., F.Z.S.,
*Helminthologist to the London School of Tropical Medicine.*

## UNUSUAL CASES OF ONCHOCERCA VOLVULUS FROM LAGOS.

By George M. Gray, M.D.
(*From the Helminthological Laboratory, London School of Tropical Medicine.*)

The number of cases of *Filaria volvulus* on record is very few, and the common position for the tumour caused by the parasite is, according to these records, on the thorax immediately under the skin in the line of the ribs. In two cases that came under my notice during my recent tour in Southern Nigeria, the tumours were situated in the lower part of the trunk. In one case, that of a Yoruba, a native belonging to Olokemeji, it was situated posteriorly over the lower end of the sacrum, and in the other anteriorly over the right pubic ramus.

In both cases the tumours were a little larger in size than a tangerine orange, and were firmly adhered to the periosteum covering the bone. The presence of these tumours gave rise to no definite symptoms, and were merely a cause of inconvenience to the patients.

In the first of the two cases the swelling simulated in character and position a sacro-coccygeal tumour. It was incised, and a mass of delicate filament was found and removed with a sharp spoon. These filaments proved, on more careful examination, to be pieces of *Onchocerca volvulus*. The cavity was packed with gauze, allowed to granulate, and healed up in about three weeks.

The second case was that of a Hausa, who had come from Northern Nigeria, but was seen at the hospital at Lagos. This tumour was round, tense, and very elastic, and was situated a little below the external abdominal ring. The patient came to the hospital complaining of rupture. The superficial abdominal ring was found to be quite free, and the tumour was considered to be a dermoid cyst. It was cut down upon and shelled out, some difficulty being experienced owing to its firm adhesion to the periosteum covering the pubic bone. The wound was stitched up and healed in a few days.

The structure of the parasite and its pathology have already been fully investigated by Fulleborn, Parsons, and others. The special interest in these two cases lies in the fact that whereas tumours described by others have been freely movable, in both these cases they were firmly attached to the periosteum, whilst the presence of onchocerca tumours in these particular positions adds to the difficulty of differential diagnosis.

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## (b) Summary of Current Helminthological Literature.

### NEW SPECIES OF THE TREMATODE GENUS TELORCHIS.

(*Hygienic Laboratory Bulletin*, No. 71, U.S.A. Public Health and Marine Hospital Service, p. 86.)

Goldberger gives a useful key for the species of *Cercorchis*, a sub-genus of *Telorchis*. Of the fourteen species included three are new, viz., *Telorchis stossichi*, *T. attenuatus* and *T. robustus*. These are described and illustrated.

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### A NEW SPECIES OF TREMATODE IN MONKEYS.

(*Hygienic Laboratory Bulletin*, No. 71, U.S.A. Public Health and Marine Hospital Service, p. 48.)

Goldberger and Crane have discovered in the liver of the South American *Cebus capucinus* a second species for the genus *Asthemia*. *A. foxi* n. sp. differs from *A. heterolecithodes* which occurs in the liver of a Madagascar bird, in that the body is more slender and the cæca do not extend so far backwards, failing to overshoot the vitelline zone.

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### ENDOPARASITIC TREMATODES IN AMERICAN FRESHWATER FISH.

(*Hygienic Laboratory Bulletin*, No. 71, U.S.A. Public Health and Marine Hospital Service, p. 7.)

Goldberger has re-examined and described in detail *Leuceruthrus micropteri*, the type specimens and species of Leuceruthrus. He thinks that this genus will probably be found to constitute the type of, at least, a new sub-family *Leuceruthriinæ* in the *Fascioloidea*.

Two new species from the stomach of *Amia clava* are added to the genus *Azygia*, so that the extended genus now comprises *A. lucii*, *A. loossii*, *A. bulbosa*, n. sp., *A. acuminata*, n. sp.

A new genus *Hassallius* is created for *H. hassalli* n. sp. from the stomach of *Ambloplites rupestris*. The genus is closely allied to *Azygia* and *Ptychogonimus*, differing from the former in external characters and in the lateral situation of the ovary in relation to testes, from the latter in the character of the genital atrium and the uterus.

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## THE ASCARIDÆ OF CARNIVORES.

(*Comptes-rendus de la Soc. de Biologie*, February, 1911.)

RAILLIET and Henry have investigated the so-called *Ascaris canis* of cats and dogs and other carnivores and confirm the previous work of Leiper, in which it was shown that the parasites included under the name *Ascaris* or *mystax* belong not merely to two separate species but fall into two quite distinct genera *Toxascaris* and *Belascaris*. Railliet and Henry add further characters to the differential diagnosis of these genera and describe two new species.

## Personal Notes.

### COLONIAL MEDICAL SERVICE.

Dr. D. Alexander, Medical Officer of Northern Nigeria, has been transferred to Sierra Leone as Junior Sanitary Officer on augmentation of the establishment.

Dr. H. H Scott has been appointed Government Bacteriologist and Fermentation Chemist in Jamaica.

Dr. S. S. Cameron, Chief Veterinary Officer and Head of the Dairy Supervision Branch of the Department of Agriculture, Victoria, Australia, has been offered the position of Director of Agriculture, which has been occupied with conspicuous success by Dr. T. Cherry.

*West African Medical Staff.*

*No deaths.*
*No resignations.*
*No retirements.*
*No promotions.*

*Transfer.* — H. C. Jeffreys, B.A.Oxon., M.R.C.S.Eng., L.R.C.P.Lond., Medical Officer, Sierra Leone, has been transferred to Northern Nigeria.

*New Appointment.*—C. S. Thompson, M.B., B.S.Durham, has been selected for appointment to the Staff, and assigned to Southern Nigeria.

*Other Colonies and Protectorates.*

E. N. Darwent, M.D., C.M.Edin., Resident Surgeon of the Colonial Hospital, Trinidad, has been appointed District Medical Officer, Arima District, Trinidad.

### COLONIAL CIVIL SERVICE.

Dr. G. J. Rutherford, a Senior Medical Officer of the Gold Coast Colony, has been selected for the office of Assistant Principal Civil Medical Officer of Ceylon in succession to Dr. C. T. Griffin. Dr. Rutherford joined the West African Government Service in 1897 as an Assistant Colonial Surgeon in the Gold Coast Colony and attained the position of a Senior Medical Officer five years ago. He has also served in Southern Nigeria. He is expected to assume the duties of his new appointment next month.

Dr. T. J. Cobbe, of the Medical Department of Uganda, has become Medical Officer at Entebbe.

Dr. J. Halley has taken over the duties of Chief Medical Officer and Superintendent of the Public Lunatic Asylum, Fiji, during the absence on leave of the Hon. G. W. A. Lynch. Before proceeding to Fiji in 1903 Dr. Halley served in West and South Africa.

Dr. R. Latimer Green has been appointed Acting Principal Medical Officer of Sarawak.

Dr. A. Hipwell has been appointed a Medical Officer, Southern Nigeria.

Dr. E. L. Singer has been appointed a Medical Officer, South Nigeria.

### THE SOCIETY OF TROPICAL MEDICINE AND HYGIENE.

At a meeting of the Society of Tropical Medicine and Hygiene, held at 11, Chandos Street, Cavendish Square, W., on Friday, March 17, 1911, the following candidates were elected Fellows: John B. Alexander, M.B., Wick; Henry Anderson, M.D., Queensland; Charles T. Andrew, M.B., Chin Wang Tao; G. W. R. Black, M.D., Hong Kong; Gabrielle R. S. Breeze, M.B., Tangier; George Guy Butler, M.B., Lynmouth; Captain John P. Cameron, I.M.S.; George R. H. Chall, M.R.C.S., Nairobi; Captain Howard Crossle, I.M.S.; Max des Ligneris, M.D., Transvaal; John Farrington, M.R.C.S., Fiji; Major James H. Hugo, I.M.S.; Major Spencer Hunt, I.M.S.; W. Hamilton Jefferys, M.D., Shanghai; Alexander F. Kennedy, M.B., Coleraine; F. Markland Longson, M.B., Selangor; John R. McDill, M.D., Manila; Ernest E. Maples, M.D., F.R.C.S., Forcados; Jorge Martinez, M.D., Bogota; Isaac P. Masters, M.B., Pahang; Major Charles Milne, I.M.S.; Michael W. Morrison, M.R.C.S., Grenada; Ralph W. Nauss, M.D., Runcorn; Arthur J. R. O'Brien, M.B., London; George N. Palmoer, M.R.C.S., Bonna; Thomas Rennie, M.D., Foochow; Walter H. Scott, M.R.C.S., Newton Abbott; John O. Shircore, M.B., Nyasaland; Frank Standish, M.B., Selangor; William H. T. Storrs, M.R.C.S., Rhodesia; G. W. Uytenhoudt, M.D., Zaandam; Frank Wells, M.R.C.S., London; Christopher J. Wilson, M.B., Cobham; Wu Lien Teh, M.D., Tientsin.

## NOTICE.

### XV. INTERNATIONAL CONGRESS OF HYGIENE AND DEMOGRAPHY, WASHINGTON, D.C.

DEAR SIR,—I beg to inform you that I am in receipt of a letter, dated January 28, 1911, from Dr. John S. Fulton, Secretary-General of the Congress, stating that the Congress will be held in Washington, D.C., on September 23-28, 1912.

Further announcements will be issued from Washington about the beginning of April.

Yours faithfully,
G. H. F. NUTTALL,
*Hon. Secretary British National Committee for International Congresses of Hygiene and Demography.*

BROMURAL.—A case has recently been related in which a woman, aged 34, took thirty 5-gr. tablets prepared by Knoll and Co., London, at a dose. The effect was sound and deep sleep for thirty-six hours without deleterious effect. The harmlessness of this drug would seem thereby to be proved.


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1.—Manuscripts sent in cannot be returned.

2.—As our contributors are for the most part resident abroad, proofs will not be submitted to those dwelling outside the United Kingdom, unless specially desired and arranged for.

3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.

4.—Authors desiring reprints of their communications to the JOURNAL OF TROPICAL MEDICINE AND HYGIENE should communicate with the Publishers.

5.—Correspondents should look for replies under the heading "Answers to Correspondents."

## Original Communications.

# THE *RÔLE* OF THE INFECTIVE GRANULE IN CERTAIN PROTOZOAL INFECTIONS AS ILLUSTRATED BY THE SPIROCHÆTOSIS OF SUDANESE FOWLS.

### Preliminary Note.

By Andrew Balfour, M.D., &c.

*Director, Wellcome Tropical Research Laboratories, Gordon College (Khartoum).*

On several occasions I have contributed papers on the "Spirochætosis of Sudanese Fowls" to the Journal of Tropical Medicine and Hygiene, the last contribution being on October 1, 1909. I there stated, "It is easy to formulate theories but hard to prove them correct; and owing to the difficulty of observing these small bodies (the intra-corpuscular forms) and granules (set free from the red cells) in the fresh blood more work is required upon them, and special methods may have to be adopted." It is by the use of these latter, and more especially the dark-field method of illumination and the employment of the Levaditi-Yamamato method for staining sections of tissues, and a slight modification of it for blood films, that the interesting problem presented by this disease of fowls has, I believe, at length been cleared up. Not only so, but the more recent investigations may possibly throw light on what is at present obscure in the case of other spirochætal infections.

The full account of these later researches will be presented in the Fourth Report of these laboratories, which is now in the Press, and is due to appear in the autumn of the present year, and here I wish merely to place on record a few of the more salient features of the work.

It will perhaps be remembered that one found intra-corpuscular forms in this fowl spirochætosis and that, following Sambon, one had come to the conclusion that these endoglobular bodies represented a stage in the life-cycle of the spirochæte, constituted in short its stage of schizogony in the fowl. Sambon, however, who expressed this view from the study of a few slides I gave him, did not indicate how this red cell invasion occurred. For a long time I believed the spirochætes themselves entered the red cells and broke up, or coiled up, within them to form these remarkable bodies. As the parasites can and do enter and leave the erythroblasts of the fowl there was good ground for this supposition. Now, however, I know better. By the use of the dark-field method and more especially by practising liver puncture on chicks at the crisis or on chicks which have been given a sufficiently large dose of "606" I have found that in the liver in particular, also in the spleen and lung, the spirochætes undergo an astonishing change. *They discharge from their periplastic sheaths spherical granules*, and it is apparently these granules which enter the red cells, develop in them and complete a cycle of schizogony. The appearance is very remarkable. If a well-infected chick be given a dose of "606" the peripheral blood is soon cleared or nearly cleared, of spirochætes. If then a drop of liver juice be examined by the dark-field method it will be found swarming with spirochætes, and with highly refractile granules. The source of the latter is soon apparent, for attention will be directed to spirochætes which are not moving in the usual way but are in a state of violent contortion or are, so to speak, shaking themselves to and fro. Indeed I cannot give a more apt comparison than by likening their movements to those of dogs which have been in water and are shaking themselves vigorously to dry their coats. The object of the spirochætes, however, is to rid themselves of the bright, spherical granules which can be seen within them, and which may or may not be aggregations of the so-called chromatin core. These are forced along the periplastic sheath and suddenly discharged from one or other end of the parasite, so that they become free in the medium and dance hither and thither as tiny, solid, spherical, brilliantly-white particles. In process of time the spirochæte loses its activity, becomes difficult to see, and eventually all that is left of it is the limp and lifeless sheath drifting aimlessly in the fluid and liable to be caught up and swept away by some still vigorous parasite. Such a sheath may still retain one or two of the granules which it has been unable to discharge. As may be imagined the process is most fascinating to watch, and my observations have been confirmed by Captain Fry and Mr. Buchanan of these laboratories, and by Major Ensor and Captain O'Farrell, R.A.M.C. I may also say that the first-named had previously seen a shedding off of granules by trypanosomes in the peripheral blood of experimental animals, a phenomenon which he is now studying.

It is these spirochæte granules in the liver, spleen and lung, and possibly also in other internal organs, which I believe invade the red cells. I think I have seen the penetration occur, but require to make further observations, in order to be certain as to the mode of entry. Such a chain of events fully explains all the puzzling features which this intra-corpuscular infection has hitherto presented; and, moreover, brings it into line with the infective granules found in the ticks, for these very closely resemble those seen in liver juice films, both when examined by the dark-field method, and when stained by the Levaditi-Yamamato process.

Until my laboratory assistant, Mr. Buchanan, modified this method, one had considerable difficulty owing to the deposit which formed on films. Now, however, one can obtain a clean film which shows the granules, both in the spirochætes and lying free. The process is as follows: Smears are fixed in absolute alcohol for ten minutes and washed thoroughly in distilled water, after which each slide is placed in an oblong glass trough containing about 10 cc. of a filtered solution of 5 per cent. silver nitrate. The film side faces downwards, and the slide rests on small glass rods in order to prevent contact with the bottom of the trough. The troughs are placed on a glass slab, and over them is put a suitable glass cover the edges of which, where it is in contact with the slab, being sealed by vaseline. The whole is then placed in the incubator at 37° C. for two days, at the end of which time the films are *very thoroughly*

washed in running tap water for about ten minutes. They are then treated with filtered reducing solution (pyrogallic acid 2 per cent., tannic acid 1 per cent.), under the same conditions as above, and incubated at 37° C. for an hour or so. They are then again washed *very thoroughly* in running water and transferred to fresh reducing solution, in which they are left in the incubator for two days. They are finally *very thoroughly* washed and dried.

As will be seen this method does not differ from the Yamamato modification of the Levaditi process, save as regards the very thorough washing and the more prolonged treatment with the reducing solution.

By its use I have recently been able to confirm observations made with the dark-field upon the peripheral blood of chicks at the crisis, and to show that this granule-shedding occurs, not only in the internal organs, but in the circulating blood stream. Moreover, the same thing happens to spirochætes ingested by ticks, and it is no doubt in this very way that the granules of Leishman are formed. It is indeed remarkable, that while the latter take on the Romanowsky stain, the granules shed in the blood of fowls and chicks cannot apparently be coloured by this method until they have entered the red cells, a curious fact which may explain why they have not been hitherto observed in other spirochætal infections. It is, however, worth noting, that so-called "coccoid" bodies have been seen in the blood in human relapsing fever. Were these free spirochæte granules?

I see that Jowett in South Africa has recently discovered what appears to be an identical form of fowl spirochætosis, and I trust he will employ the dark-field method, and endeavour by liver puncture and the use of "606," for the purpose of creating an artificial crisis, to follow out the curious cycle I have indicated. From these observations and others which will be fully detailed at a later date, I have come to the conclusion that this fowl spirochæte must be classed as a specific entity, and I am proposing for it the name, *Spirochæta granulosa penetrans*, nov. sp., which, though lengthy, suitably indicates its more important peculiarities. At the same time it is quite possible, nay even probable, that other pathogenic spirochætes behave in a similar manner. I have found these granules to be resistant forms, and their presence in countless numbers in the tissues might explain part of the mechanism of relapse, and the difficulty of curing completely some of the more chronic spirochætal infections as, for example, syphilis and yaws.

In conclusion I must thank Professor Ehrlich for most kindly placing at my disposal an ample supply of his new and valuable remedy.

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**"Revue de Médecine et d'Hygiène Tropicales," vol. vii., No. 4, p. 265.**

M. de Beurmann gives an interesting clinical account of a Parisian who, during a visit to Palestine, contracted twelve oriental sores on the lower extremities. They appeared simultaneously. The patient attributed the infection to bites of mosquitoes received during a stay of two nights without nets in Jericho.

## THREE UNUSUAL *POST MORTEMS* FROM BRITISH GUIANA.

By E. P. Minett, M.D., D.P.H., D.T.M. & H.
*Assistant Government Bacteriologist, British Guiana.*

### (1) A Case of Hydatid Disease of the Kidney.

Considering the enormous amount of protozoal and entozoal disease present in the Tropics, and also the wretched conditions in which the majority of patients admitted to hospital have lived, it is somewhat surprising that in a country like British Guiana, where the conditions are so eminently suitable for the extra-corporeal life-cycle of the cestodes, trematodes and nematodes, comparatively few cases of echinococcus disease are met with, nor indeed is the presence of *Tænia solium* or *Tænia saginata* in the intestines by any means common. I have examined hundreds of specimens of fæces, principally for ankylostomum ova, but have very rarely detected either the ova or the adult proglottids of any species of cestode. Considering the frequency with which the *Ankylostomum duodenale* and the *Ascaris lumbricoïdes* are present in the intestines, as seen in the *post-mortem* room, one might think that all varieties of intestinal parasites would be equally common. This, however, does not seem to be the case in British Guiana. In 600 *post mortems* I have performed this year in the pathology department of the Government laboratory, I have found echinococcus disease in only two cases. In one of these a hydatid cyst was present in the liver, and even this case was something of a surprise, as the original cyst had become infected with *Bacillus coli*, and was full of pus. It was only with extreme difficulty that we could identify a portion of the original cyst wall, showing the presence of scolices. Indeed, the case was assumed to be one of liver abscess, and would probably have escaped notice were it not that Dr. Wise and myself were at that time searching scrapings from the walls of abscess cavities in the liver for the presence of the *Entamœba histolytica* of dysentery, and in that way the true nature of the cyst was detected. The second case is one which appears to me to be of considerable interest, if only from the confirmation it gives to the statements that the physiologists make to us that people are able to live and get along quite well for a considerable period of time with only half the normal amount of kidney secreting substance.

The principal site of hydatid disease would appear, according to Adami, to be the liver, although he also states that hydatids may be present in almost every organ. My colleague Dr. Wise has, I believe, recorded a case in which hydatid cysts were present in practically every one of the viscera, the whole of the intestines, liver, kidney, and spleen being matted together by one huge mass of fibrous tissue, obviously resulting from the inflammatory reaction of the tissues caused by the presence of an enormous number of hydatid cysts. Many of these cysts contained small calculi, most probably present as the result of osmosis.

In 1,000 autopsies in the Adelaide Hospital, South Australia, hydatids were present in 49—about 5 per cent., and of these 5 were in the kidneys. Thomas also states that in 1,900 autopsies hydatids were present in the kidney in 4·7 per cent. Davaine in a synopsis of 1,862 cases finds that in 186 instances

the site was the kidneys, bladder, and genitals. Osler, quoting from Mosler at the Greifswald clinic, states that of 50 cases 3 occurred in the kidney.

An interesting case is reported by Wright in the *Lancet* of January 21, 1911, of a man aged 50 who was operated on for hydatids, which had apparently existed for 7 or 8 years, without having caused any great inconvenience.

Retroperitoneal hydatid cysts as reported by Cole (*Lancet*, February, 13, 1909) are, I think, practically unknown in British Guiana.

The history of my second case is as follows:—

G., an East Indian woman, aged 45, was admitted to the Georgetown Hospital for a foul vaginal discharge, which on examination proved to be from an ulceration of the cervix. The temperature was normal during the month in which she was in hospital, except that on one occasion it rose to 102° F. and 101° F. on two successive days. She did not complain of any inconvenience from her kidneys, but the urine was examined and shown to contain pus and albumen, doubtless as a result of the cervical lesion, but in order to obtain further evidence specimens were sent on several occasions to the pathological laboratory for examination of the centrifugalized deposit. A few granular casts were found, but on no occasion were hydatid products detected.

Allbutt and Rolleston mention that these products are occasionally found in the urine.

The patient eventually died, and at the autopsy the following abnormalities were detected:—

General condition fairly good; discharge from the vagina present.

*Lungs.*—Old fibrinous pleurisy, with adhesions, substance congested, otherwise normal.

*Heart.*—Milk spots; muscle of right ventricle wasted and pale.

*Spleen.*—Old perisplenitis, adhesions, a few hæmorrhages in substance.

*Kidneys.*—The right kidney weighed 16 oz. In the cortex was a large hydatid cyst, containing 600 small cysts. The pyramids were atrophied by pressure, the pelvis and ureter were practically normal, as was also the part of the kidney substance unaffected by the cyst. The left kidney weighed 7 oz., and was fatty, otherwise normal.

*Liver.*—Many old scars with thick bands of fibrous tissue, probably gummatous, otherwise normal.

*Uterus.*—Extensive ulceration over whole of cervix, extending well up the posterior fornix, fungating and very foul. There was acute vaginitis and profuse discharge.

Bacteriological examination of the vaginal discharge showed *Bacillus coli*, no streptococci.

Sections from the cervix showed the growth to be a squamous-celled carcinoma.

Sections from the unaffected kidney substance on the right side showed diffuse nephritis, with numerous obliterated and fibrosed glomeruli.

Surely this number of hydatid cysts in one comparatively small organ, such as the kidney, must constitute a record. Only complete cysts were counted, but as many of the larger cysts contained both daughter and grand-daughter endogenous cysts, the number is really considerably larger. The cysts were all contained in a thick fibrous sac, composed of the remnants of the capsule of the kidney, a very small portion only of the kidney substance remaining, although the pelvis and ureters were perfectly normal.

The microscopical examination of the portion of kidney substance remaining showed to my mind not nearly so much change as one would have expected, considering the enormous amount of pressure that must have been exerted by the expanding cysts; some areas indeed showed tubules with comparatively normal lining epithelium and active glomeruli that were obviously capable of performing their functions.

### (2) A Case of Gumma of the Spleen.

Gummata of various organs are by no means uncommon in British Guiana. In most of our cases the situation has been either in the liver or in the brain, while gummata of the spleen have been rare. In Fournier's analysis of 4,400 cases, he mentions gumma of the visceral system to be rare, although D'Arcy Power and Keogh Murphy state that the spleen is frequently affected in cases of congenital syphilis. Coutts, who made observations in 100 cases of congenital syphilis in children, found the spleen to be enlarged in 62 cases; and cases are on record of gumma of the spleen in boys aged 6 and 11 years respectively (*Path. Soc. Trans.*, 1897). Still claims to have diagnosed 6 cases of gumma of the liver during life. Osler describes gumma of the spleen as a rare condition of anatomical interest only.

In our case the condition of the liver and spleen was not detected during life, the patient suffering from acute phthisis.

History.—F. J., aged 23, a negro, was admitted on November 5, 1910, complaining of pain in the chest and fever. The usual signs of acute phthisis were well marked and typical, and tubercle bacilli were present in the sputum. The patient had an abscess on the left heel, and a Hunterian chancre extending round three parts of the corona glandis of the penis, also several old scars. He also, at the time of admission, suffered from fairly acute diarrhœa. He died a week later of his lung condition, complicated by an acute attack of peritonitis.

*Post mortem.*—The patient was very wasted. With the exception of the lesions noted, no further scars or syphilitic signs were detected superficially. On opening the thorax a large amount of sero-fibrinous pleurisy was seen on both sides. The upper lobes of both lungs showed acute phthisis, but no cavities were detected. The heart muscle was pale, anæmic, and wasted; the valves were natural and no atheroma of the aorta was present. Both kidneys showed fatty degeneration with well-marked tubular nephritis.

The liver was in a state of early cirrhosis, with a good deal of fatty infiltration. A gumma about one inch in diameter was present near the lower edge of the right lobe. This was surrounded by a well-marked zone of fibrous tissue, and microscopically was typical in structure. No other bands of fibrous tissue or evidences of old gummata were seen in this organ.

The spleen had a thickened capsule with well-marked old perisplenitis, together with numerous adhesions to the surrounding viscera. The splenic substance was dark and very congested; only a small amount of fibrosis was present, but situated in its centre was a large typical gumma measuring 1½ in.

in diameter, surrounded by the usual zone of fibrous tissue. The large intestine showed extensive ulceration of the cæcum and ascending colon, the ulcers being raised, with very thickened heaped-up hyperæmic edges. One ulcer had perforated down to the serous coat and given rise to the peritonitis.

The gumma of the spleen appeared to be older than that in the liver, judging by its microscopical characters. The ulceration of the intestine appeared to be syphilitic in character, especially on section.

(3) A Case of Abscess of the Spleen.

Splenic abscesses both of the acute and chronic variety are comparatively common in British Guiana, and their association with malaria seems to be fairly definite. When occurring in cases definitely diagnosed as malaria or typhoid they are usually situated near the surface of the spleen. I have seen one case in which the abscess ruptured, giving rise to a general peritonitis, and several in which it has given rise to perisplenitis and adhesions. Major Anderson, I.M.S, also records two cases of splenic abscess in malarial individuals from the Andaman Islands, and Catrin quotes Grand Mourse l as having operated on fourteen cases recognized during life, eleven of which recovered. A most interesting case is recorded by Norman Chevers from India, in which he removed over 3 lbs. of healthy pus from a splenic abscess, the patient making a complete recovery. He associates these abscesses definitely with malaria, and states that the more malignant the fever, the more likelihood of abscess formation. Osler attributes the occurrence of splenic abscess to a previous attack of septicæmia or pyæmia, but this is not, I believe, the view generally held by medical men in the Tropics, unless we attribute its presence to a pyæmia induced by a secondary infection by pathogenic organisms of a primary malarial focus. Cromwell, in the *Maryland Medical Journal*, reports a case of suppurative splenitis in a young and healthy girl, caused by tight lacing and violent exercise, 30 oz. of blood and pus being evacuated.

There do not seem to be many cases on record of splenic abscesses in association with acute filariasis, though I have seen several which, to my mind, could only be accounted for as a result of this disease. Whether the abscess is due to the coalescence of small emboli formed by the bacteria nearly always present in cases of acute filariasis, as occurs in the case of ulcerative endocarditis, pyæmia, typhoid, or intermittent fever, or whether it is a direct result of the filarial infection, is difficult to say with any degree of certainty. Personally I am of opinion that they result from the secondary bacterial infection.

The history of my case, which possibly may have had some connection with filariasis, though this is by no means definitely proved, is as follows:—

H. S., a male negro, was admitted for removal of a painful swelling under the tongue. He gave a three years' history of cough, which at the time of admission was very troublesome.

There was tenderness over the infra-mammary region, with well-marked dulness and absent breath sounds over Traube's area; and in the left infra-clavicular area the breath sounds were harsh and bronchophonous in character. At the left base there was some dulness, and a few scattered râles were heard. The patient complained of slight abdominal pain, and the bowels were loose. The liver and spleen were not palpable. No tubercle bacilli were present in the sputum, and the temperature was normal except on one occasion, when it rose to 102° F. for a few hours. Some œdema of the legs was noticed, and the urine contained a trace of albumin. Death occurred in a week.

*Post mortem.*—Body fairly well nourished. Large number of pigmented spots on legs, scars on penis.

*Lungs.* — Pleural sacs healthy. Many enlarged mediastinal glands, filled with yellow caseating material, extending along the large bronchi into roots of both lungs, not tubercular in character.

*Heart.*—A few milk spots, otherwise normal.

*Spleen.* — Four large abscess cavities, filled with inspissated pus, liquid in centre. The surrounding spleen pulp otherwise normal; no hæmorrhages.

*Kidneys.*—Small yellow fibrous nodule in cortex of right side; otherwise normal.

*Intestines.* — Matted together with gelatinous material. Enlarged lumbar and mesenteric glands filled with caseous material, a similar condition spreading up the lumbar region. Abscess in pancreas filled with caseating material.

*Bacteriological examination* showed *Bacillus coli* and *B. pyocyaneus* both in the splenic abscesses and in the glands. No tubercle bacilli or giant cells were present.

An adult *Filaria bancrofti* was found in the connective tissue of the lumbar glands.

The abscesses were evidently of long standing, as they were surrounded by a definite fibrous layer. The central portion of each showed an area of liquefaction, which I believe to be due to the action of a proteolytic diastase set free by the death of the indigenous cells as the result of the inflammation.

## THE OCCURRENCE OF *ŒSOPHAGOSTOMUM APIOSTOMUM* AS AN INTESTINAL PARASITE OF MAN IN NIGERIA.

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Introductory.

Dr. Andrew Foy, of the West African Medical Staff, was good enough whilst home on leave recently to present to the London School of Tropical Medicine a tube containing a considerable number of specimens of *Necator americanus*, passed by a patient at Ibi, Northern Nigeria. In the course of routine examination of individual specimens, I have been able to single out from the collection six examples of *Œsophagostomum apiostomum*, a parasite frequently producing serious intestinal lesions in monkeys, but hitherto apparently unknown in man, unless, as will be discussed later, *O. brumpti* is to be regarded as the same species. The specimens resemble *N. americanus* very closely in size and in general appearance, and would probably have been overlooked had they not been scrutinized with a hand lens. In external appearance they differ from *N. americanus* from a lack of the slight but characteristic crook at the anterior end of

the body. The mouth is quite terminal, and is surrounded by tiny setæ which protrude somewhat through its aperture.

In 1905, Railliet and Henry described under the title "Encore un Nouveau Sclerostomien (*O. brumpti* n. sp.) parasite de l'homme," six immature females collected from tumours in the wall of the cæcum and colon of a native on the river Omo, by M. Brumpt, during his tour in Tropical Africa in 1902.

In the year following these two authors described also *O. apiostomum* from monkeys, but although their description tallies almost exactly, even to the measurements of the various structures, with their previous account of *O. brumpti* from man, they refrain from stating the identity of these two forms.

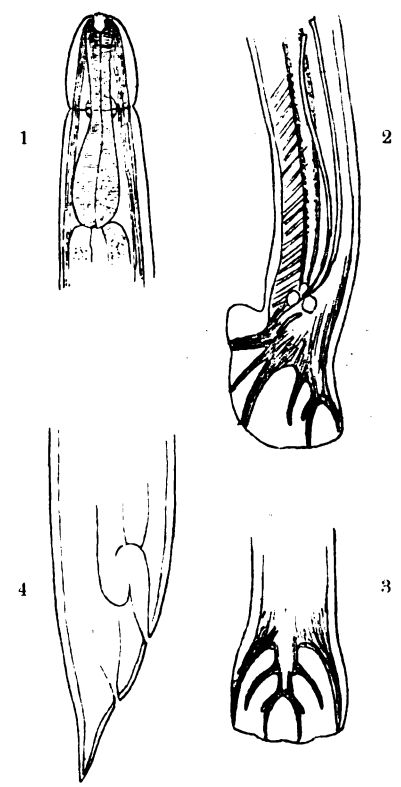
In connection with the present note, I have re-examined and compared with Dr. Foy's specimens: (*a*) Material collected by me from the great intestine of monkeys in Uganda; and (*b*) Specimens of *O. apiostomum* from *M. sinicus*, collected from cysts in the wall of the colon by Dr. Kennedy, of the Royal Army Medical Corps.

A careful comparison of the material from all these sources convinces me that Dr. Foy's case is one of infection with *O. apiostomum*. Moreover, the only distinguishing feature given by Railliet and Henry for *O. brumpti*, viz., the relative size and depth of the mouth capsule, and the presence of three curved teeth on the posterior border thereof, are characters that I find present in all the material of *O. apiostomum* from monkeys that I have examined. The forms of *Œsophagostoma* found encysted in the intestinal wall are always immature, and one must be prepared to account for slight differences in size and development in material obtained from different hosts, by the fact that specimens from one host may be a little older than those from another.

### Description of the Parasite.

The following account of *O. apiostomum* is based upon the largest pair of the specimens occurring in Dr. Foy's collection. The male measures 8 mm. in length, the female 10 mm. in length, the former being somewhat more slender than the latter and tapering from about the middle third of the body to the posterior end where it expands to form a bursa. Both sexes are a slaty grey colour, the females being somewhat darker than the males. At the anterior extremity the cuticle between the excretory pore and the mouth is dilated to form an ovoid swelling. The cuticle is transversely and deeply striated and the striæ are 0·01 mm. apart in the middle of the body. The mouth is surrounded by six circum-oral papillæ which stand out distinctly and are visible with a low magnification. Within these the oral aperture is guarded by a ring of pyramidal setæ, the tips of which are occasionally turned outwards, so as to give a somewhat misleading picture as if the tips of the pyramids were lacking. The mouth capsule is shallow, measuring 0·03 mm. in transverse diameter and 0·006 mm. antero-posteriorly, but the mouth cavity is considerably increased in size and is continued backwards by a funnel-like expansion of the anterior portion of the lumen of the œsophagus, so that the whole cavity appears to have an inverted pyriform shape. Passing down the sides of this funnel-like cavity are three cuticular ledges, which probably represent continuations of the triradiate cuticular lining of the œsophagus in the same way as the teeth of *Triodontophorus*. When these three ledges reach the posterior edge of the true buccal capsule they turn inwards, each forming a small but distinct chitinous hook. Between the three ledges the cuticular lining of the œsophageal funnel is somewhat thinned and bulges outwards, as Railliet and Henry have aptly described it, "like a scallop."

The œsophagus measures from the buccal capsule to its posterior end, 0·4 mm. in length in the male, and 0·43 mm. in the female. It is crossed at 0·15 mm. from the anterior end of the body by a nerve ring.




*Œsophagostomum apiostomum* from man. (1) Ant. end; (2) bursa of male, side view; (3) dorsal view of bursa; (4) posterior end of female.

In the male the bursa opens somewhat sub-terminally, and the median lobe is not distinctly marked off from the lateral portions. The two ventral rays are united in their whole length. Of the three lateral rays, the anterior one is separated from the two others by some distance, whilst the middle and posterior are united almost to the edge of the bursa. The dorsal ray has the characteristic outline found in all species of the genus *Œsophagostomum*. The externo-dorsal ray leaves the central trunk and passes out towards the bursal edge, taking a somewhat arcuate course. The central trunk of the dorsal ray measures about 0·1 mm. in length, and divides to form two prong-like rays, 0·1 mm. long, which make their way to the edge of the bursal membrane. Each of these subdivisions gives off at 0·05 mm. from the edge of the membrane a short curved ray near its root, which passes somewhat outwards for a very short

distance. The spicules are fairly stout, straight and colourless, measuring about 0·65 mm. in length.

In the female the posterior end of the body tapers very suddenly to a sharp acicular tail. The anus opens 0·2 mm. from its tip, and 0·15 mm. in front of the anus is the vulva. The vagina has a cuticular lining. It passes forwards for a very short distance and then divides into two uteri, one of which continues directly forwards, the other curves backwards to form a complete loop before passing forwards alongside the other. The uteri are of considerable length and have a dilated cavity. The ova resemble those of the Ankylostome fairly closely, as seen within the uterus; they measure 0·063 mm. in length by 0·027 mm. in breadth, and are segmented.

### Systematic Position.

As stated above the parasite corresponds so closely to *O. apiostomum* of monkeys and *O. brumpti* of man that I believe these two species to be one and the same. Almost thirty-two years ago v. Linstow described, in a very brief and unsatisfactory manner, a number of small œsophagostomes from *Macacus cynomolgus* under the name *Strongylus aculeatus*. His figures show certain minute differences in detail which, if correct, would probably suffice to make *S. aculeatus* distinct from *O. apiostomum*, but should a re-examination of the original material prove, as seems probable, that these discrepancies are due to the rough character of the illustrations, then the name *O. apiostomum* will have to give place, under the law of priority, to that of *O. aculeatum*.

### Pathology.

In Dr. Foy's case the parasites were passed in the course of treatment for ankylostomiasis, and no clinical or pathological notes are available. In Mr. Brumpt's case only six nodules containing the parasites were found. So that up to the present nothing is known of the clinical phenomena associated with their presence in man. There is no reason to think, however, that the symptoms in man in a heavy infection would differ in any essential from those observed in monkeys and already described by several observers. The best and fullest account of the lesions is that by M. Weinberg in *Archives de Parasitologie*, vol. xiii., p. 161, 1908. Of eighty monkeys belonging to the genus *Macacus* no less than thirty-four were found by him to be infected with *O. apiostomum*. It is supposed that the œsophagostome larvæ reach the wall of the great intestine by the blood stream, and are arrested either in the sub-mucosa or in the muscular layer, giving rise to hæmorrhagic cysts. In the cysts the larvæ undergo ecdysis and attain to immature adults. The cysts rupture later and the œsophagostomes are thus set free in the lumen of the gut where they attain sexual maturity. The cysts may become invaded by bacteria, whence the peritoneum may become infected and a generalized peritonitis follow or septicæmia may result as in the case of a monkey, *Cercopithecus callitrichus*, suffering from œsophagostomiasis, in which M. Romanovitch found a polymicrobic septicæmia. Exceptionally, intestinal hæmorrhage may occur. Hewlett and De Korte have noticed dysenteric symptoms in a certain percentage of their cases.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THE JOURNAL OF

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April 15, 1911.


## PLAGUE: ASSISTANCE FOR CHINA AND INDIA.

The rather acrimonious discussion going on at present in the columns of *The Times* and other papers, concerning the endeavour to send out from Britain medical men and money to Manchuria to deal with the outbreak of plague prevailing there, whilst nothing, some say, has been done for our fellow-subjects in India, where the disease has been and is more widely spread, more persistent and responsible for even a larger number of deaths in populations of equal amounts, is somewhat of an absurdity. It is the old cry in another form, perhaps, used against foreign missionary effort, viz.—"Better redeem the social and religious delinquents at home than spend millions of money on people who are not of our kin, and who professedly do not want our teaching." The answer to these arguments cannot be summed up in a single sentence so as to convince the ignorant. The question of foreign missions has been answered again and again, and their justification established upon unshakable foundations, and the rights and the wrongs of the question of medical help to China and India on account of plague can be equally easily explained and settled with a little inquiry and thought.

In China there are no Chinese medical men upon whom the Government can fall back for either advice or immediate help. There is no public health department, no organized medical service, no trained nurses, nor any modern appliances whereby an out-

break of disease in an epidemic form can be handled or met. China is to-day where we were in the "fifties," when even in our armies medical and sanitary organizations were unknown, and it was only by the horrors of the Crimean war that the matter was brought to light.

Since then system has been the order of the day, and we have the satisfaction of knowing that Britain taught the world the meaning of sanitary organization in theory and practice.

In India, we have well-organized government departments for both sanitation and medical purposes; the medical department is systematized and developed in a degree unknown in its completeness in perhaps any other country; the resources at the disposal of the government are well-nigh illimitable; the medical schools in India are equipped to a degree known only to those who have seen them, and the medical men sent forth from these universities and schools are capable of playing their part with intelligence and accuracy. There is, therefore, no comparison between the wants of India and China in regard to medical equipment to meet the wants of an epidemic. China is destitute of any provision for the event; India can call up resources in men and money as they are required. To deny China help because the plague is carrying off its tens of thousands in India is not charity in any sense of the word; the Chinese are helpless in the face of the outbreak; India is not so. Nor must it be argued because people are dying in great numbers in India the medical arrangements are inefficient. We have not yet got far enough in our fight against disease to enable us to wholly prevent all diseases, nor to guarantee a cure for all ailments, especially for so rarely recurrent an epidemic as plague. Until the present epidemic appeared in 1894, this generation has never had an opportunity of studying plague scientifically. Much has been done in the time, much more remains to be done before we can come to definite conclusions as to how plague is to be met and dealt with.

The mere virulence of an epidemic is not a mark or proof of inefficiency of organization, especially when a disease which is practically new to us suddenly appears for which there is no specific cure known. Certainly let us have all the help we can give to India; and it is only for the Indian Government to say that such help is required to find it forthcoming. Such help has not been asked for, and until it is do not let us quibble over sending help to China, which is utterly unable to organize a system of relief against a widespread epidemic. The lull in the outbreak in Manchuria is in harmony with the behaviour of epidemic plague; it is not gone; it will appear again as the cycle of its epidemiology recurs. For seventeen years it has recurred in Southern China regularly; and every year almost to the day the disease declares itself with persistent regularity. Whilst the disease is in abeyance is the time for action, but it is difficult to bring this fact home to even the most intelligent of Governments. We are accustomed to epidemics which sweep over us and spend their force; but plague differs from other epidemics; it persists, it recurs with clock-like regularity, and its latest outbreak may prove more virulent than its predecessor.

The steps to be taken to check plague are gradually being forged, but until mankind appreciates the fact that one outbreak but breeds the next, so long will it continue to recur. During the excitement of an epidemic is the wrong time to take preventive measures for eradication; it is during the yearly succeeding lulls that an endeavour must be made, but it will take a considerable time yet to convince the public—and therefore the authorities—that the time to spend the money on preventive measures is during the intervals between epidemics. This is a condition of mind no nation has yet attained; and as far as we can judge by comparing what is spent during the lulls, and the prodigality with which money is lavished during the outbreaks, it will be many a year before this consummation will be reached. J. C.

## Helminthology.

### (a) Original Investigations.

### ON KWAN'S FLUKE AND THE PRESENCE OF SPINES IN FASCIOLOPSIS.

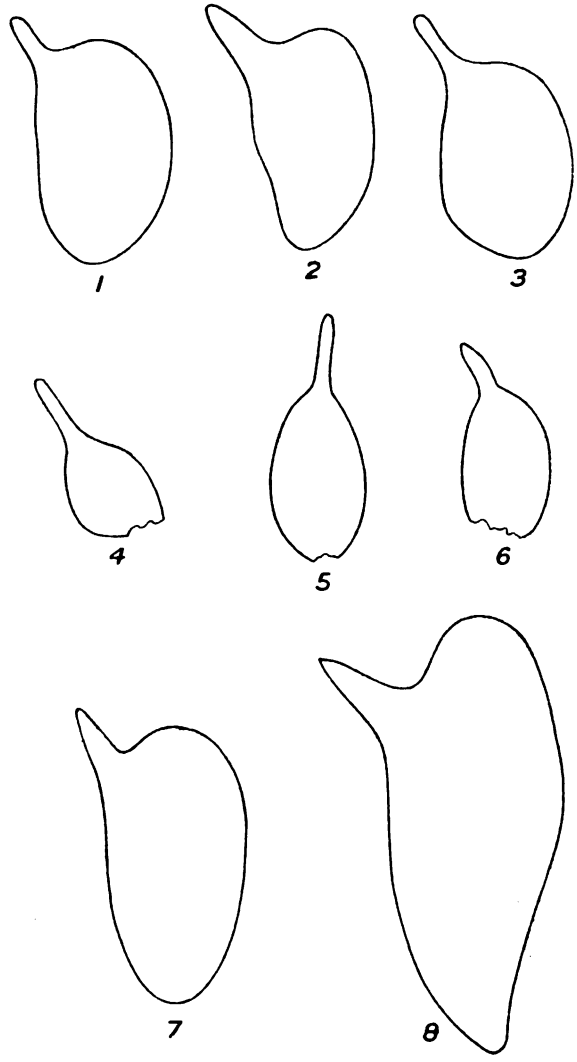
A TREMATODE found by Dr. Kwan King Hung in a child at Hong Kong, and described and figured by Heanley in the JOURNAL OF TROPICAL MEDICINE, April 15, 1908, is now passing into the literature as a "doubtful" species, and has appeared in some of the most recent textbooks under the designation Kwan's Fluke. Once a species, however doubtful, has gained access to medical text-books its eradication is exceedingly difficult—*e.g.*, the so-called *Filaria gigas*, which is still quoted by many, though rejected by all workers in helminthology. It seems right, therefore, that I should take an early opportunity of stating the results of an examination of the original material on which the diagnosis of Kwan's Fluke was based. The parasite is a large fleshy fluke about 2 in. in length, and ½ in. in breadth. It shows the characteristic branched testes and ovary, the diffuse yoke glands, wavy gut, coiled uterus, and the prolonged cirrus of *Fasciolopsis*. The anterior end of the body shows those differences upon which a differentiation of the species from *F. buski* was suggested. The explanation of these features is, however, very simple, especially when it is recalled that the patient suffered from vomiting which resulted in the expulsion of the worm by the mouth. The anterior end of the parasite had undergone a certain amount of maceration as a result of the action of the gastric juices. The body wall covering in the ventral sucker was so digested away as to allow this stout sucker to swing almost free. When the specimen was mounted the sucker lay with its posterior dorsal prolongation projecting forwards in the middle line, resembling in this new position a mass of tissue corresponding to oral sucker and pharynx. The orifice of the ventral sucker then appeared in a normal position to give entry to a round cavity, recalling that found in *F. hepatica*. Until interpreted in this manner the structures at the anterior end of the fluke are exceedingly perplexing, and it is not very surprising that a new find was suspected.

Another feature which was noted by Heanley and

has misled recorders, was the presence of spines on the skin. In practically all the writings upon *F. buski* and its allied species great stress is placed upon the absence of cuticular spines. Heanley, with reference to Kwan's Fluke and the Fasciolopsis found in pigs, and Jeffery's writing on the South China variety of Fasciolopsis assert that spines are to be found on the skin, but Odhner, Ward, Looss, Braun and Rodenwaldt either adopt the view generally held, or specifically state that spines are absent. During the last three years I have had a number of opportunities of studying specimens of Fasciolopsis from India and China, both from man and animals. I have come to the conclusion that the presence of spines is a *normal* feature in the genus *Fasciolopsis*. The spines are neither so stout nor so dense, nor so deeply set in the cuticle as in *Fasciola*. Consequently, in specimens passed after treatment, they may be wholly or for the most part lacking. They certainly are deciduous. Most probably it will be found that they are not uniformly distributed over the whole body even in perfectly fresh specimens. The spines are most stoutly developed around the genital pore on the ventral surface. In this situation they are actually depicted, though their significance is missed by Odhner in his classical memoir on *F. buski*. In specimens from the same material as that upon which Ward based his revived species, *F. rathouisi*, and the new form *F. goddardi*, I find spines also present, although Ward emphatically states that they are absent. Whilst in sections of the originals upon which Rodenwaldt founded the species, *F. fulleborni*, I have been able to see the regularly set pits in the cuticle, out of which the spines have undoubtedly fallen in the course of preparation for the microtome. When mounted in Canada balsam the spines are exceedingly difficult to see and may often be invisible. Their presence even in these cases can be demonstrated, however, by dissolving the balsam in xylol, and allowing the specimen to project somewhat from the fluid. The spines then stand out like minute bristles. In a future note I hope to discuss the systematic value of the various species of *Fasciolopsis* that have recently been created.

## SOME VARIATIONS IN THE CHARACTER AND POSITION OF THE SPINE IN EGGS OF *SCHISTOSOMUM HÆMATOBIUM*.

In a recent number of the Journal of Tropical Medicine and Hygiene I figured and described as a constant feature the presence of a lateral knob in the eggs of *Schistosomum japonicum*. A further study of the material has brought to light the further interesting fact that there are two kinds of eggs, viz., those containing a fully developed miracidium and those containing little but fatty globules. In both kinds the shell shows the same lateral knob. In *S. japonicum*, then, it would appear little probable that parthenogenesis occurs, or that the female when fertilized produces different kinds of eggs from those produced when virgin. One must not be too hasty, however, in drawing inferences from *S. japonicum* and applying them to *S. hæmatobium*. In cases infected with the latter species, as is well known, there have been observed since the time of Bilharz, who discovered the parasite, two kinds of eggs; one with a terminal and one with a lateral spine. Various explanations have been offered for these cases; only those maintained by Manson and by Looss now hold the field. The former claims that there are two species, with both distinct and overlapping distribution, each giving rise to a special shape of egg. The latter is convinced that the two different shapes of eggshell are the product of the female of the one species, the lateral spine occurring in unfertilized eggs proceeding to develop parthenogenetically, the terminal spine occurring in




fertilized eggs. According to the former view it seemed almost essential that the two typical eggs should never occur in the same female; for the latter, such should be found after sufficient search. During the last two years I have undertaken such a search, and have been indebted to Dr. Turner, Transvaal, for the abundant material upon which this was made. The results have been difficult to interpret by either hypothesis satisfactorily, and lend some support to the view enunciated by Ward that there may indeed be a separate species with normal lateral spined egg, whilst

an abnormal lateral spined egg may be produced occasionally by the *S. hæmatobium*. We shall try to show that there are several grounds for thinking this explanation admissible.

The figures of the accompanying block illustrate a number of eggs, all drawn to the same magnification. Fig. 8 is an accurate outline of a typical lateral-spined egg (*S. mansoni*) whilst still within the female ootype. Figs. 1 to 6 represent a consecutive series of eggs found in the uterus of a female taken from the liver; No. 6 was the most recently formed, No. 1 lay just within the vulvar opening. Egg No. 7 is an accurate outline of the picture of the lateral-spined egg as seen by Professor Looss.

It will be noticed at a glance that whereas the eggs found in terminal parts of the female worm (figs. 1, 2) resemble in entire outline, and in the shape, relative size, and character of the spine, the figure given by Looss; they bear little correspondence in detail to the typical egg given in fig. 8.

The eggs 1 to 6 were each rolled to show the greatest amount of lateral distortion of the spine, so that it cannot be said that the eggs are really all lateral spined, but were seen from different views. The specimen establishes the fact insisted on by Looss that one may get both a lateral and a terminal (or almost terminal) egg in the same female; but on the other hand these do not correspond exactly to the lateral-spined eggs hypothecated by Manson as typifying a new species.

There is another point of interest. Eggs 4 to 6 were all small and incomplete; according to Looss's view we must suppose that there occurs a period of rest between the formation of parthenogenetic ova and fertilized ova. The eggs here seen are not typical terminally pointed eggs, but merely egg-shells not yet accurately or perfectly formed. This is an exceedingly suggestive point, in view of the fact that the female has obviously been producing fully formed eggs previous to this (*vide* figs. 1, 2), and of lateral type.

There are, however, one or two details in which I fail to follow Professor Looss's explanations. He believes that in those cases where there are lateral spined eggs in the fæces it will be found that the bulk has come from the liver by the bile. This explanation certainly does not hold good for Piraja da Silva's or Turner's cases, in which I have microscopically examined hundreds of eggs still imbedded in the tissues of the great intestine. In these cases I did not come across a single terminal spined egg. Nor do I think his explanation of the mode in which the terminally spined egg may be earlier converted into a laterally spined one (by the distortion due to accumulated yoke matter in the ootype), will suffice to account for the peculiar and almost constant outline of the egg as shown in fig. 8.

Some of the figures, especially 4, 5, 6, suggest an interpretation of a peculiar bilharzia egg found once in a case of ordinary urinary bilharziasis by Stevens and Christophers. Most probably the egg described by them, with its long snout-like spine, was an abnormal product of a sexually immature *S. hæmatobium*.

R. T. Leiper, M.B., F.Z.S.,
*Helminthologist to the London School of Tropical Medicine.*

## (b) Summary of Current Helminthological Literature.

### A NEW SUB-FAMILY *AVITELLININÆ* OF TAPEWORMS.

(L. H. Gough, *Quarterly Journal of Microscopical Science*, February, 1911, p. 317.)

L. H. Gough makes an important contribution to our knowledge of the anatomy and histology of the tapeworms with unarmed heads that occur in the domesticated animals. A reinvestigation of the various species of the genus *Stilesia* has enabled him to confirm the previous observations of Stiles on the many peculiarities of *S. centripunctata* and to separate this species as type of a new genus *Avitellina*. The new genus has four distinct sets of testicles in each segment, one on the right and one on the left of each longitudinal canal. The uterus is single and there is a single paruterine organ. The genus *Stilesia* which now contains the species *S. globipunctata*, *S. hepatica*, *S. sjostedti* and *S. vittata* has two sets of testicles in each segment. The uterus is double and there are two paruterine organs.

There is an entire absence of vitelligene and shell glands, the eggs receiving their nourishment from nutritive cells formed in the ovary and uterus, in both *Avitellina* and *Stilesia*. These genera are accordingly separated from the subfamily *Thysanosominæ* to form a new subfamily *Avitellininæ* in the family *Anoplocephalidæ*.

The second half of the paper is devoted to a detailed description of the histology of *Avitellina centripunctata* and the following are the more important of the conclusions: There is no subcuticula in the suckers, the cuticle can arise independently of the subcuticle. The subcuticular cells are in direct connection with the dorso-ventral and transverse muscles.

### DESCRIPTION OF FOUR *FILARIA LOA* FROM THE SAME PATIENT.

(Huffman and Wherry, *Parasitology*, p. 7, vol. iv., 1, March, 1911).

The specimens recorded in this paper were removed from the eye of a patient who had contracted the infection outside Batanga, Cameroons, West Africa. The authors corroborate, in the main, Looss's description. The bosses on the cuticle are said not to be so high, the cuticle is thicker and with Ludwig very delicate transverse striæ are seen on the female tail. It may well be, as the authors state, that most of the drawings so far published are somewhat misleading, but the Plate of eight figures which accompanies their text is simply valueless.

R. T. L.

## Parasitology.

### A New Indian Anopheline.[1]

S. R. Christopherson describes a new species *Neocellia fowleri* from Amritsar and the Central Provinces of India. It most closely resembles *Nyssorhynchus fuliginosus*, from which it differs in the generally lighter colour of the insect as a whole, in the marked scale structure of the abdomen, scales being present on

all the segments except the first, in the wing markings which resemble those of *N. theobaldi*, and in the absence of a distinct apical white band to the second hind tarsal segment. From other species it differs in the absence of speckling of the legs, &c.

### A New Culicine Genus.[1]

S. R. Christopherson gives in some detail the characters of *L. tæniorhynchoides* n. sp., which he considers the type of a new Genus *Leslieomyia*. The new genus approaches most nearly to *Howardina*, but differs in its scutellar characters. There are, moreover, six very conspicuous chætæ instead of four.

### List of the known Indian Anophelinæ.[1]

S. P. James lists thirty-nine named or described species, and six described varieties of Anophelines known to occur in India. Of these, five have been conclusively proved, by the determination of sporozoits in the salivary glands, to act as carriers and transmitters of malaria in Nature, viz., *Myzomyia culicifacies*, *M. listoni*, *Nyssorhynchus fuliginosus*, *N. maculipalpis*, *Neocellia stephensi*.

### Structure and Development of Spirochætes.[2]

In view of the uncertainty still prevailing as to the structure and biological relationships of the spirochætes, W. C. Bosanquet has investigated *Spirochæta anodontæ*. He finds that the so-called undulating membrane in this species varies in appearance with the fixation of the preparations and is inclined to regard it as an artifact. He believes that he has observed longitudinal fission taking place, the daughter individuals resulting being indistinguishable from the other forms present, and that this spirochæte also goes through a stage in development, in which it breaks up into coccoid bodies, just as, according to Leishman, occurs in the tick, in *S. duttoni*.

### Thomasina: A New Culicine Genus from the Amazon.[3]

The species *Mansonia longipalpis* has hitherto been known only from female specimens, and on account of the general resemblance in the scale structure had been referred to the genus *Mansonia*. An examination of males now shows that in this species the palpi of the male are short, those of the female relatively long. The fourth tarsal segments of the fore and mid-legs are very small and flattened in both sexes. On these grounds a new genus *Thomasina* has become necessary for the accommodation of *M. longipalpis*.

### Protozoan Parasites from Trichoptera.[4]

D. L. Mackinnon describes and figures under the name *Embadomonas agilis*, n.g., n.sp., a new flagellate found in about 60 per cent. of trichopterid larvæ. She defines the new genus by the following characters: "Slipper-shaped mono-flagellate with pointed posterior end and blunt, rounded, anterior end, which is bent back at an angle with the long axis of the body. A large cytostome occupies almost all the anterior half of the body. The slender flagellum arises from a basal granule on the anterior margin of the cytostome. The nucleus is a diffuse mass containing several chromatin clumps; it lies in the extreme anterior end, in front of the cytostome."

### The Stomoxyidæ of Dahomey.[5]

The Stomoxyidæ of Dahomey are represented, according to Roubaud, by the genera *Stomoxys* and *Lyperosia*. The latter genus supplies only one species, viz., *L. longipalpis*. Of *Stomoxys* there is a considerable number, viz., *S. calcitrans*, *S. korogwensis*, *S. brunnipes*, *S. Bouvieri*, *S. glauca*, *S. inornata*, and two novelties, *S. boueti*, *S. pallida*. *S. boueti* approaches most closely to *S. bouvieri*, but the black bands on the thorax in the new species are irregular and indistinct, whereas in *S. bouvieri* they are distinct and separate in both sexes.

*S. pallida* is closely allied, on the other hand, to *S. inornata*, but whilst the latter has an entirely black body, in the former the abdomen is yellow.

In a section on the biology of the group it is noted that species of the genus *Oxybelus* attack the various Stomoxys, apparently attracted by their odour.

### Trypanosomes in Cattle in France.[6]

A rich culture of trypanosomes has been procured by P. Delanoe from the blood of six out of a herd of ten cattle at Alfort on the addition of 3 cm. of completely defibrinated blood to each 10 cm. of ordinary bouillon, the mixture being kept at the temperature of the laboratory for from one to two weeks.

## Notes and News.

Dr. Gilbert E. Brooke has started the *Malaya Medical Journal* again, four years having now elapsed since a local journal appeared in Singapore. The editor hopes that all medical men in Malaya and the Far East will do their best to support the periodical in the future. He specially asks for regular or frequent records of any matters of pathological interest that daily occur in their work, and believes if this is forthcoming that success will follow. With adequate support the hope is to produce the journal quarterly, the next number to appear in April. The present number (vol. ix., part 1, January, 1911) contains some interesting papers with useful clinical and other notes.

### Association of Medical Officers of Missionary Societies.

Resolution passed at a Meeting, November 15, 1910:—That this Association, having taken into its careful consideration the fuller information and statistics which are now forthcoming as to the results of anti-typhoid inoculation, is of opinion that the time has come when its use should be strongly advised for all

[1] *Paludism*, No. 2, January, 1911.
[2] *Quarterly Journal Microscop. Sci.*, vol. 56, pt. 2, February, 1911.
[3] Newstead and Carter: *Annals and Magazine of Tropical Medicine and Parasitology*, vol. iv., 4, March, 1911.
[4] Mackinnon: *Parasitology*, vol. iv., 1, p. 30, March, 1911.
[5] *Bulletin de la Société de Pathologie Exotique*, iv., No. 2, 1911.

Missionaries serving in India and other warm countries. As the evidence shows that the high degree of protection against typhoid fever conferred by the vaccine lasts for about two years, it is desirable to carry out periodic reinoculation at this interval.

The Association earnestly recommends the inoculation of outgoing Missionaries, and of all Missionaries when on their furlough, if not also during their periods of service; the wives of Missionaries and other persons sent to the field to be included.

The Association believes that a large saving in time and health and expense would be effected, and a saving in the lives of Missionaries, if these recommendations were carried out.

With regard to climate, typhoid fever is met with in most missionary fields, throughout the world, in a degree sufficient to justify at least an initial inoculation. It is regarded as specially important for the following fields, as the disease there is specially prevalent: India and Ceylon, Syria, Palestine, Egypt, Persia, the greater part of China, Siberia, North and South Africa, Madagascar, and the central and southern parts of South America.

G. Basil Price, M.D. (Secretary to the Association),
42, Welbeck Street, W.

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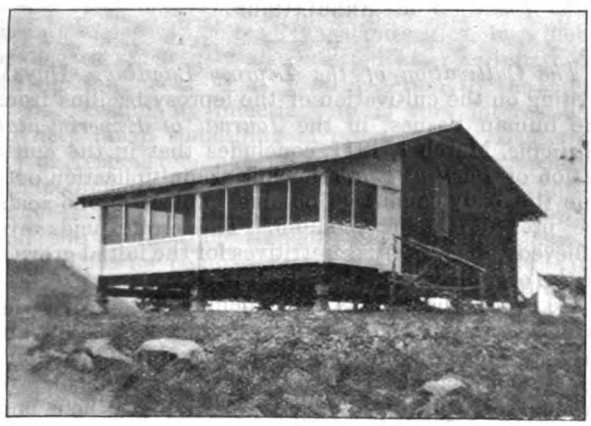
*An Insect-proof House.*—The following illustration shows a well-planned-out bungalow suitable for the Tropics or sub-Tropics. The illustration is a reproduction of a photograph of a house recently erected in



Rhodesia by Dr. Oswald Baker. The bungalow contains four rooms and a large mosquito-proof verandah 10 ft. deep and 25 ft. long. One of the features of the verandah is that the wire gauze is fixed to frames, hinged at the top, which lift up and are held by hooks attached to the ceiling, so that during the day the windows can be freely opened if desired. The iron supports of the structure have saucers round them, these being filled with crude coal tar and paraffin, so that all ants and other creeping or crawling insects are effectually barred from entrance. The only disadvantage is that the galvanized iron roof will make things very hot inside when the sun is strong, but such roofs have been found to be preferable to thatched ones in Uganda and other places. A well-laid layer of felt underneath will help to mitigate this discomfort considerably.

## Translation.

### The "Clayton" Gas as a Destroyer of Rats and Insects.

*Translation of an Extract from the Memoranda of Dr. Jayme Salvado, Physician to the Management of the Sanitary Service of Rio de Janeiro, entitled:* "Disinfections and the 'Clayton' Apparatus at the Port of Rio de Janeiro."

From what I have observed the results obtained were good. There were vessels, on board of which the number of rats killed by "Clayton" gas amounted to 200; in many cases this number was over 100, and on board the little cruiser "Tiradentes" eighty rats were destroyed at one time.

It is well known that both mercantile and war vessels harbor considerable numbers of rats, whose complete destruction is very difficult, especially in the case of warships, on account of their complicated structure. A great number of methods for the destruction of rats on board ship have been proposed and applied, but all have their weak points and have not given good results. It is an incontestable fact that the use of "Clayton" gas has produced the best results, and will continue to do so until a more efficacious method is invented, for, whilst disinfecting, it destroys at the same time rodents, and—a still further advantage—all insects which it reaches. As regards these latter, I know of nothing so effective. One can admit the possibility of the complete destruction of rats on board ship by other means than "Clayton" gas; but I see no possibility of destroying, by one single operation, bugs, fleas, mosquitoes, flies, and all kinds of insects, otherwise than by the use of this gas, which has a proved insecticidal action possessed neither by formaldehyde nor by chlorine.

As to the destruction of ants the results have been splendid, and this has been so thoroughly attested both in our naval and merchant marine that no one doubts the utility of these fumigations, and as a result our services are frequently solicited.

The destruction of rats is useful not only from a sanitary but also from an economical standpoint, on account of the considerable amount of damage caused to vessels and their cargos by rodents. Since I have been able to organize disinfection, the Brazilian Lloyd agents have acknowledged—according to statements made by them to Dr. Oswaldo Cruz during his voyage to North Brazil—that goods, especially those in bags, arrive in port in perfect condition, instead of being considerably damaged by rats, as formerly.

Another great advantage derived from the use of "Clayton" gas (an advantage which I believe I have been the first to point out) is that whilst destroying insects, it not only contributes to the preservation of cereals, pulse, &c. (which is a great economical advantage), but it also prevents deterioration of foodstuffs by insects, which is of advantage from a sanitary point of view.

"Clayton" gas is the first disinfectant capable of preserving and keeping articles of food in a sound condition, instead of causing deterioration in them.

With regard to the action of "Clayton" gas on insects, I will give some details of my observations. I have experimented with the flea, bug, fly, mosquito, and ant.[1] Cockroaches also perish in great numbers. I have seen ships in which the quantities destroyed were such as to cause the greatest astonishment. Insects which infest books are also killed by this gas, more or less quickly, as soon as it reaches a certain concentration.

The elimination of fleas, bugs, cockroaches, &c., is one of the greatest services rendered by "Clayton" gas on board ship, and this alone is sufficient to prove its superiority to all other disinfecting gases.

The bug is one of the insects which most frequently infests ships. I have several times verified their destruction by "Clayton" gas, whilst in other vessels, where formal was used, they continued to multiply.

Admitting the part played by the flea as an agent in the transmission of plague, there was a certain amount of interest in finding out if the gas, in killing the rats, might not leave alive the parasites infesting them. To clear up this point I made the following experiment: I imprisoned a rat in a trap (in the form of a cage) by the side of a glass tube containing fleas, and closed at the two ends by cotton wool. I then exposed both the trap and tube to the fumes of "Clayton" gas in a closed compartment supplied with glass windows, through which the operation could be watched. By the side I placed the suction pipe of the machine, so that I could note the strength of the gas every five minutes. The rat died in about ten minutes after the commencement of the operation, while the fleas were still alive in spite of 6 per cent. shown by the burette. However, when this reached 8 per cent. they all died, from which I drew the conclusion that "Clayton" gas kills both fleas and rats. It must be noted, however, that it takes a higher percentage of gas to kill the insect than to kill the rodent.

I repeated the experiments with fleas, bugs, flies, ants, and other insects, even bibliophages, and have always verified the good results from the use of the gas, and at the same time I was able to compare the resisting power of the various insects, and to prove that those possessing the most resistance were the ant and a book-eating insect.

On account of the susceptibility of insects, we have in "Clayton" gas a guarantee for the prevention of yellow fever on board ship.[2] Further, as the part played by several insects in numerous other diseases has been determined, the importance of "Clayton "gas is increased all the more, and its use is to be prescribed in many cases, as scientists have positively pointed out the *rôle* played by these creatures in the transmission of infectious germs.

Yersin, for example, proved the existence of the plague bacillus in the stomach of flies found in the room of a plague patient. Several other observers, viz., Simond, Ogata, and Hankin, according to Khayat, confirmed these observations on fleas, ants, bugs, cockroaches, &c , and Dr. W. Goodhue noticed in the Hawaiian Isles that the bacillus of leprosy is met with in *Culex pungens*, the bug and the cockroach.[1] The results of the investigations of the part played by mosquitoes in malaria and yellow fever represent great achievements in modern medicinal science, recognized at the present time by the whole world. I will say the same regarding the transmission of filariasis, which Manson attributed, with reason, to the mosquito. Thus, the part played by a number of insects in the dissemination and propagation of plague and other dangerous diseases is henceforth demonstrated, and the disinfectant capable of destroying them in their haunts should render great services to humanity. "Clayton" gas is, fortunately, this valuable agent.

[Editorial Note.—Similar experiments have of course been carried out with "Clayton" gas in England and elsewhere. At the experimental chamber of the Clayton Company, situated in the East India Docks, London, E., the students of the London School of Tropical Medicine annually see the process at work, specially noting the effects of the gas on rats, insects of all sorts, food-stuffs, and disease germs such as bacilli and cocci.]

[1] It was the ant which figured in my experiments; in consequence of the results obtained I am persuaded that agriculture will gain a great deal by adopting the "Clayton" apparatus to kill these ants.

[2] In the fumigation of houses for yellow fever, the use of the "Clayton" machine should be equally useful, especially in the case of basement and cellars, as I have already mentioned to one of my colleagues in prophylaxy.

## Annotations.

*The Cultivation of the Leprosy Bacillus.*—Duval, writing on the cultivation of the leprosy bacillus from the human tissues, in the *Journal of Experimental Medicine*, March 1, 1911, concludes that in the cultivation of *Bacillus lepræ* the initial multiplication outside the body cannot be obtained unless amino-acids are present in the medium. The amino-acids are believed to be essential nutritives for the initial growth of the organisms.

He states that it has been demonstrated that the primary growth of the leprosy bacilli occurs only in the presence of the products of tryptic digestion; hence, putrefactive and other bacteria which are capable of splitting nucleo-proteids into their end acid products are, in consequence, of value in the isolation and cultivation of the leprosy bacilli. Amœbæ are not necessary for securing the primary multiplication of the leprosy bacilli upon artificial media, and are detrimental since they feed with avidity upon the bacilli themselves.

Two methods may be employed for recovering in culture *Bacillus lepræ* from the tissues. In one (the direct) tryptophane or a mixture of albumen and trypsin are employed with a culture medium; in the other (indirect) bacterial species capable of digesting the albumen constituent of the culture medium are introduced into the medium. In both, the end result is identical, since they both provide for the presence of the amino-acids in the medium, without which

[1] "Reviste Medico de Saint Paul du," 30 Mars, 1908.

the primary multiplication of the leprosy bacilli cannot be secured.

*Sleeping Sickness in Nyasaland and Northern Rhodesia.*—Stannus in the *Sleeping Sickness Diary of the Nyasaland Protectorate* (part 13), reports further on the work that has been recently carried out in Nyasaland and North-Eastern Rhodesia in regard to the spread of sleeping sickness. The British South Africa Company, as mentioned in the JOURNAL OF TROPICAL MEDICINE AND HYGIENE (March 1, 1911, pp. 77) is sending a special commission to North-Eastern Rhodesia to thoroughly study the outbreak prevailing there now and the future work of this commission, together with the careful observations being carried out by the Nyasaland Medical Officers, should help to clear up much of the mystery that still prevails about these cases. During the past two months Dr. Sanderson has detected three more cases of human trypanosomiasis in the Dowa sub-district of Nyasaland, and Dr. Prentice one at Ngara. In North-Eastern Rhodesia five further cases have recently been reported, two in Europeans, three in natives; the two European cases both seem to have become infected after poisoned wounds on the neck caused by the bites of tsetse flies, the fly in question being apparently without the slightest doubt the *Glossina morsitans*. As in other Rhodesian cases both of these showed a very virulent infection, one dying in twenty-five days after the first signs of infection, pneumonia and diarrhœa being the immediate cause of death. Dr. Stannus calls attention to the resemblance of the infection of these two patients to case 12 of his Nyasaland series, in which the disease apparently also started after an inflamed bite on the neck. This local reaction to the bite of the presumably infecting fly is very interesting and may mean something of importance. Bacteria may be responsible, but why should they not appear more commonly after other bites as well. Dr. Stannus further states that no fresh light has been thrown upon the method of transmission of the disease; *G. morsitans* he believes to be the likely agent. It is to be hoped that the commission above mentioned will finally settle this point.

*Kala-azar in Malta.*—In the *Transactions of the United Services Medical Society*, October to December, 1910, are published two interesting papers on kala-azar in Malta. These were read before the Malta Branch of the Society on October 31, 1910. Captain Baker, R.A.M.C., contributed some notes on a case in a male infant, 19 months old, in which the characteristic parasites were found *post mortem*, while Captain Babington, in addition to describing a case seen in a gunner in the Royal Garrison Artillery, aged 21, also discussed the prevalence of the disease in Malta generally. He drew attention to the fact that leucocythæmia figures largely amongst the death-rate of the children of the island, and queried if such a diagnosis could be borne out by the actual facts.

Such a case examined by himself showed a leucopenia instead of a leucocytosis, and evidently was a case of kala-azar and had nothing to do with leucocythæmia. Dr. Critien's work corroborates this, he having found kala-azar parasites in the spleen juice of similar cases, and he has now recorded and published in the *Archives de l'Institut de Pasteur de Tunis*, six definite Maltese cases. Captain Babington believes that at present there are insufficient grounds for warranting the assumption that the Mediterranean kala-azar parasite is different from the Indian variety. He points out that the latter (the Indian) also exacts a heavy toll amongst children, and that as regards the former (the Mediterranean) adults are by no means immune, several cases in people from 18 upwards having been recorded.

Dogs appear to suffer naturally from a similar disease, Nicolle going so far as to say that the infantile kala-azar of Tunis is an infection of the dog transmissible to children. Other observers, Basile near Messina and at Rome, Da Silva in Lisbon, and Critien in Malta, for example, have also recovered similar parasites from dogs, but, on the other hand, Donovan in India has failed to find such parasites in 1,150 examinations, and so has Jemna in 227 dogs at Palermo where infantile kala-azar exists. It may be, then, that this dog parasite is another species and has nothing to do with the human disease. Following Ensor's suggestion, Critien has tried senega for the cure of the disease, and he states that he has noted great improvement in some of his cases.

*The Prevention of Malaria in India.*—The second number of *Paludism*, the transactions of the Committee for the study of malaria in India, appeared last January. It is edited by Major S. P. James, M.D., I.M.S., Secretary to the Committee. A number of interesting papers appear in the present number, and the editorial record tells what has been done up to date. The Bureau seems to be a distinct success, and has filled a distinct want in providing a place where specimens can be permanently and safely deposited, remaining at the same time available to the officer who sent them and to others in India. In addition to mosquitoes, other collections have been started, including collections of fish and the common aquatic flora and fauna encountered by those carrying on malarial investigation. A start has also been made in collecting preparations of quinine likely to be useful in India. The first number of *Paludism* created a demand that exceeded expectations, and arrangements have therefore been made that forthcoming numbers may be bought from any of the agents who sell Government publications. Another feature of the publication is the part dealing with the recent literature of malarial prevention. Papers relating to this in India and other countries are dealt with. Dr. Bentley's criticisms on Dr. Malcolm Watson's Federated Malay States work will be certain to raise an animated discussion, but fair criticism is good for all, and it is only right that a paper like *Paludism* should criticize as well as merely record current work. The war against malaria in India is evidently, therefore, going ahead, and much is to be hoped for from the Committee in the future.

*The Viability of Intestinal Ova.*—In the Public Health Reports (vol. xxv., No. 50) of the United States Marine Hospital Service there are some

interesting observations on the viability of the ova of various parasites. A series of experiments were made under irregular conditions, simulating those found in Nature, as, for instance, in a cotton-mill village. Stiles, in his report, summarizes the matter as follows:—

(1) It is not safe at present to assume that the sand under and around a privy is entirely free from hookworm infection five months (151 days) after the privy was last used.

(2) After about four months (120 days), however, the infection may be very greatly reduced, and possibly in some instances entirely dead.

(3) After about five months (150 days) in sand, living *Ascaris* embryos in the eggs may be found, even when all the hookworm larvæ observed are dead. *Ascaris* eggs, apparently alive and normal, were found after 156 days.

(4) Hookworm eggs may be identified in sand cultures 117 days old.

(5) When fæcal material is subjected to decomposition in water for seventy days (namely, about two and one-third months), the mass of hookworm eggs die, but a few can survive.

(6) No hookworm egg has as yet been found alive in fæces subjected to decomposition for 117 to 149 days—namely, about four to five months.

(4) It seems very probable from present data, that under the conditions under which these observations were conducted, if fæcal matter containing hookworm eggs is subjected to decomposition in water for about three months, all hookworm infection will be dead.

(8) In fæces allowed to decompose in water, *Ascaris* eggs resist the decomposition better than do the hookworm ova. At the end of about four months (117 to 121 days), however, at least 80 per cent. of the *Ascaris* eggs appear to be dead.

(9) The action of chloride of lime in the strength of approximately ¼ lb. to 10½ qrt. of water for twenty-two to forty hours does not kill hookworm eggs.

(10) If fly-blown fæcal material is buried under 17 in. of sterilized sand, flies (*Ophrya leucostoma*) will crawl through the sand and complete their development.

(11) When fly-blown fæcal material was buried under 48 in. of clean (unsterilized) sand, flies (*Musca domestica*) issued from the surface.

(12) When fly-blown fæcal material was buried under 72 in. of clean (unsterilized) sand, flies (genus and species undetermined) issued from the surface.

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*Ulcerating Granuloma.*—In the *Australian Medical Gazette*, February 20, 1911, Strangman contributes "A Preliminary Note on the Pathogeny of Ulcerating Granuloma." This disease seems to be fairly common in the northern territory of Australia, and is, generally speaking, limited to the reproductive organs and surrounding parts, though primary lesions may also be met with on the breast, axilla, and neck.

Strangman divides the disease clinically into two types: (1) The granulomatous; and (2) the sclerosing, the former of which may merge into the latter. Suitably prepared sections from the lesions show clusters of spherical bodies exhibiting a uniform appearance without any apparent internal structure, these being acid-fast, Gram-positive, and answering the description of the coccus-like clusters found in the somewhat similar lesions of botryomyces. In other sections small bodies are found in the protoplasm of the large round cells. Spirilla and spirochætes are also seen, many other organisms, yeasts, cocci, &c., being present as well.

These results bear out what has already been discovered by Wise in British Guiana, Donovan in India, and others elsewhere. Small rod-like parasites with elongated nuclei contained in the mononuclear cells have been demonstrated; and possibly Strangman's are the same as those. A parasite of this nature is perhaps more likely to be the causative agent than a spirochæte, but on the other the *Treponema pallidum* causes granulomatous lesions; and there is no reason therefore why an organism of a similar nature should not do the same.

A solution of the nature of this repulsive and disfiguring ailment would be welcome.

## Recent and Current Literature.

*A list of recent publications and articles bearing on tropical diseases is given below. To readers interested in any branch of tropical literature mentioned in these lists the Editors of the* JOURNAL OF TROPICAL MEDICINE AND HYGIENE *will be pleased, when possible, to send, on application, the medical journals in which the articles appear.*

### "Malaria e Malattie dei Paesi Caldi."

The above journal reports a case of kala-azar from near Rome (Notizie, p. 30). The patient was a young man of 19, who came from Castelnuovo, Port of Fiumicino. He presented himself at the Medical Clinique at Rome with the clinical symptoms of Leishmaniasis. Death ultimately took place, and at the autopsy the characteristic parasites were found in the spleen. Another case, a child, has also died in Rome of the same disease. The same number also contains articles on "Oriental Sore" and on "The Transmission of Kala-azar."

### The "Sleeping Sickness Bulletin," March 14, 1911 (1911, No. 25, vol. iii.).

The contents of the Bulletin for the month mentioned are as follows: (1) Antelope as a Sleeping Sickness Reservoir (this paper appeared in full in THE JOURNAL OF TROPICAL MEDICINE AND HYGIENE of March 1, 1911); (2) Transmission of Trypanosomes; (3) Chronicity in Sleeping Sickness; (4) Treatment of Trypanosome Infections; (5) The Pathology of Skin Eruptions; (6) Bionomics of Glossina; (7) The Bird-lime Method of Trapping Tsetse; (8) Acquired Immunity in Sheep and Goats; (9) Animal Trypanosomiases; (10) The Human Trypanosome in Vertebrate Blood; (11) Toxin Formation in Trypanosomiasis; (12) Sleeping Sickness news; (13) Sleeping Sickness Conference; (14) Monthly list of references.

### "The Journal of the American Medical Association," March 11, 1911.

Mullowney writes on the Plague in North China. The disease, he states, started at Harbin, and up to January 24, 1911, about 1,500 Chinese and twenty-seven Europeans had died. So far as he is aware, this is the first definite epidemic of the pneumonic type of the disease, almost all the cases being of this or the septicæmic variety. Haffkine's vaccine seems to have been of value as a prophylactic, the reverse being the case with Yersin's serum in treatment. From Harbin the disease has spread along the line of railway

traffic to Mukden, to Shanhaikwan, to Tientsin, and to Pekin, as well as to several smaller places. It has also reached Chefu, which is a sea coast town, probably through some Chinese coolies returning from the North in a Chinese junk or fishing boat.

**"Sleeping Sickness Bulletin," February 15, 1911 (vol. iii., No. 24).**

Dr. Bagshawe mentions the autopsy of a cured case of human trypanosomiasis. Dr. Mott reported on the pathological findings of the case to the Royal Society last January. The patient was a Sikh, who contracted the disease in 1905 in Uganda. In June, 1910, he appeared in perfect health, fluid removed by lumbar puncture at that date showing no cells or trypanosomes. In August, 1910, he died of pneumonia—apart from the pneumonia nothing indicative of sleeping sickness was noted at the autopsy. The brain and other organs were sent home, and Dr. Mott prepared sections of these. There was no trace of perivascular or meningeal infiltrations nor of gliosis, while sections of the spleen, liver and kidneys also gave negative results.

**"Archivos do Instituto Bacteriologico Camara Pestana," vol. iii., part 2, 1911.**

SERUM DIAGNOSIS OF SYPHILIS.

A. de Azevedo Gomes gives a lucid and comprehensive review of the literature dealing with the Serum Diagnosis of Syphilis. His conclusions briefly are: The reaction of Wassermann, Neisser and Brück, although one of the most striking advances of modern biology, is not a true reaction between antigen and antibody. It constitutes a certain and practicable method for the diagnosis of syphilis. Its present restrictions are due entirely to faults of technique, to the variable composition and modes of preparation of the extracts, to failure to titrate the antigens employed, and also to the different standards by which observers test their results.

Clinically it is destined to attain the greatest importance in the differential diagnosis of syphilis, in the diagnosis of general paralysis and of tabes, and seems to confirm the syphilitic origin of these two affections.

**"Medical Record," February 18, 1911.**

Kanstoroom brings forward a theory that trachoma is connected with malaria. He states that the negro race is practically immune against it and is also resistant to malaria. This would seem an unfortunate statement as what about the negro children and their predilection to malaria. He further quotes Norris and Oliver as saying "Trachoma is not a simple local disease, due to a specific infection by a special germ from the outside, but it is a local manifestation of a dyscrasia." This may be so, but there is no evidence that this dyscrasia is malarial.

In the above journal's letter from the Philippines (page 312) it is stated that, "it is now practically nine months since unpolished rice has been exclusively used at the Culion leper colony as the staple article of diet, and not only has beri-beri completely disappeared after being continuously present for over five years, but no new cases have occurred amongst the inmates" Three apparently new cases of beri-beri were proved to have been admitted with the disease upon them.

This statement confirms in a very marked manner the work of Fraser and Stanton at Kuala Lumpur.

**"New York Medical Journal," February 25, 1911.**

Rosenheck and Rohdenburg of New York report a case of chyluria in which the *Cercomonas hominis* was also present. The case was that of a coloured man from the Island of St. Thomas in the West Indies, who had been living in New York for the past two years. On December 1, 1910, he passed milky urine and an examination of this, during the first two days of his illness, revealed a moderate number of *Cercomonas hominis*. As the disease progressed these became less and less frequent, until at the end of two weeks they could no longer be found. The contention of the authors that this might be classed as a non-parasitic (*e.g.* non-filarial) chyluria is absurd. Manifestly from the history of the residence in the West Indies the case was a filarial one, and very probably, if the authors had examined the patient's night blood, they would have found embryos of *Filaria bancrofti* present.

**"Medical Record," March 11, 1911.**

Paul and James Pilcher, New York, describe a filarial case of chyluria which they met with in their practice in that city. The patient was a native of British Guiana, a married lady of 35, white. She had resided there all her life until five years ago, when she then went to Brooklyn. Four years after leaving the tropics she began to pass milky urine. By cystoscopic examination and urethral catheterisation the authors determined the absence of lymphatic varices in the bladder, and further that the chylous urine was being secreted from the left ureter only. Filarial embryos (*F. bancrofti*) were present in the night blood, but were never found in the chylous urine. Six-tenths of a gramme of salvarsan was given hypodermically and in forty-eight hours the urine became clear. It again became chylous, however, and the authors then believed they saw dead filariæ in the urine. Blood smears taken after that date did not again show embryos. The case wants following up, as such phenomena as described often take place irrespective of any drug treatment.

**"The British Medical Journal," March 18, 1911.**

Alston, of Trinidad, gives further details of his treatment of yaws with salvarsan ("606"). Since his first communication in the *British Medical Journal* of February 18, 1911 (p. 360) he has injected 8 more cases, bringing his total therefore up to 21 cases. He now gives the results, each case receiving only one injection.

| | | |
|---|---|---|
| Cured .. .. .. | 13, or 61·9 per cent. | |
| Nearly cured .. .. | 3, or 14·3 | ,, |
| Stationary .. .. | 5, or 23·8 | ,, |

The shortest period taken to cure was thirteen days, and the longest twenty-eight days. He found that salvarsan had no effect on yaws tubercles of the nostrils (tubercles situated at the junction of the mucous membrane of the nose and the skin); this failure was noted in two cases treated by salvarsan and in one treated by serum taken from a patient who had previously had salvarsan.

**"The Lancet," March 25, 1911.**

The Milroy Lectures for 1911 were delivered by Dr. A. E. Boycott, who chose for his subject "Ankylostoma Infection." His second lecture appears in the number of *The Lancet* quoted above. It deals with the outbreak of ankylostomiasis which appeared in Cornwall some years ago, and also enters into the conditions which determine the prevalence of the infection, the influence of fæcal contamination, insanitary conditions influencing the spread and conditions favouring infection by the skin. A good synopsis of recent work on ankylostomiasis abroad is given in the course of the lecture and the matter contained in it is worthy of study by tropical students.

**"Journ. Amer. Medical Association," February 11, 1911.**

TRANSFUSION IN PELLAGRA.

Dr. H. P. Cole, on August 4, 1908, employed the first transfusion in the terminal stages of pellagra. Encouraged by the immediate improvement and rapid recovery in this patient, in collaboration with Dr. Gilman J. Winthrop, Dr. Cole has since transfused nineteen additional patients in the terminal stages of the disease.

Whereas they are unable to draw positive conclusions from this number of cases, they believe that certain valuable

deductions may be derived from the statistics which they present.

Transfusion has been resorted to only in cases in the last stages of pellagra, or steadily retrograding under prolonged and careful treatment by approved therapeutic measures.

| | Cases | Recoveries |
|---|---|---|
| Transfused .. .. .. .. | 20 .. | 12 |
| Females, aged 22-53.. .. .. | 16 .. | 8 |
| Males, aged 3-42 .. .. .. | 4 .. | 1 |

| | Cases |
|---|---|
| Temporary improvement followed by death .. | 2 |
| No improvement following transfusion .. .. | 6 |
| Complications incompatible with recovery .. | 2 |

Two patients were moribund at the time of operation.

Four of the eight cases in which death resulted might well be excluded, for potent reasons. Considering the grave mortality rate in the type of patients on whom transfusion was performed, the mortality rate of 40 per cent. in the entire twenty cases compares most favourably with the mortality (80 to 90 per cent.) in this type of case treated by other therapeutic procedures. Neither hæmolysis nor agglutination, thrombosis nor embolism, were observed in any of the cases.

A far greater percentage of recovery occurred in the females. All the recovered patients presented distinct and severe lesions of pellagra; there were marked emaciation, asthenia, anæmia, reflex excitability, and in many cases grave mental changes. Severe pellagra erythema, stomatitis, and diarrhœa were present in a majority of the cases. Within a few days after transfusion there was either alleviation or disappearance of all the symptoms of pellagra; there was a rapid disappearance of the pellagra erythema, stomatitis and diarrhœa, and also a gradual alleviation of the mental and nervous symptoms. In several cases there was an astonishing improvement in the patient's mental condition, shortly following operation. In all cases there was rapid increase in the patients' hæmoglobin index, a rapid return of body strength, a return of digestive faculties, and an increase of body weight. All the recovered patients gained from 3 lb. to 8½ lb. in the first week following transfusion; one patient gaining 34 lb. within eleven weeks. All the recovered patients have returned to a normal condition within from one to four months after operation; several are in better physical condition than they have presented for years.

It is but just to state that all approved therapeutic procedures were employed in the recovered cases, both previous to and following the operation.

The necessity of resorting to transfusion can be ascertained only on the appearance of positive signs of retrogression under approved institutional and constitutional therapeutic agents.

In these transfusions the authors endeavoured to employ donors who have lived in the same environment as the recipients, assuming that such donors who have not contracted pellagra possess a certain degree of immunity.

Transfusion was resorted to from donors who had recovered from pellagra in three cases; and from donors who had never had pellagra in seventeen cases. There seems no preference of a donor who has had pellagra over a donor who has never had pellagra; nor of the use of a relative over the use of a non-relative.

The recoveries (60 per cent.) following transfusion in the grave type of cases compares most favourably with the recoveries (10 to 20 per cent.) in the same type of cases in which other therapeutic measures are employed.

The employment of transfusion in the terminal stages of pellagra must be undertaken with a full knowledge of the difficulties and dangers of the operation. Without careful selection of the cases and unprejudiced conclusions this procedure will fall into an undeserved ill repute.

## Drugs and Appliances.

THE Anglo-American Pharmaceutical Company, Ltd., 59, Dingwall Road, Croydon, have recently brought out some new preparations. Huxley's Proteid Food contains 50 per cent. assimilable proteids with lactic ferments of Bulgarian milk and glycerophosphates. It is a delicious concentrated food for invalids, convalescents, weakly children and others. It supplies the maximum of nutrition with the minimum of digestive effort. Syrupus glycerophosph. co. acidus (Huxley) (compound syrup of the acid glycero-phosphates) is a preparation which will be found of use in convalescence from debilitating diseases and in conditions when people are run down. It contains $\frac{1}{250}$ of a grain of strychnine in the fluid drachm. Fermenlactyl put up in tablet form is another preparation. This is a lactic ferment which will correct fermentive dyspepsia and autointoxications of the intestine. These tablets may be eaten in the dry state or they may be used in preparing "sour milk," two tablets being used to each tumbler; care being taken that the milk is just lukewarm.

CHARCOAL has been found useful in many digestive disturbances, many chronic dyspeptics having experienced great relief from its use. This being the case a suitable preparation of the substance is a necessity. Messrs. J. L Bragg, Ltd., of 14, Wigmore Street, W., put up several charcoal and other preparations in pleasant form, all the charcoal ones being kept in stock by chemists, while the others will be sent direct on application by the manufacturers. The goods are made by patent machinery, so the possibility of contamination by hand labour is avoided and absolute purity ensured.

## Personal Notes.

INDIA OFFICE.

*Arrivals Reported in London.*—Captain E. T. Harris, I.M.S.; Captain W. H. Leonard, I.M.S.

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3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.

4.—Authors desiring reprints of their communications to the JOURNAL OF TROPICAL MEDICINE AND HYGIENE should communicate with the Publishers.

5.—Correspondents should look for replies under the heading "Answers to Correspondents."

# Original Communications.

## INFECTION BY *SCHISTOSOMUM JAPONICUM.*

By A. H. Skinner, M.D.Aberd.

In the middle of January, 1910, a Eurasian youth, aged 19, of a well-to-do family, walked into my surgery in Hankow (Central China), and asked to be treated for "indigestion and weakness." He had been receiving treatment for that complaint from a doctor in Shanghai.

His condition was as follows: Appearance extremely anæmic, suggesting pernicious anæmia or severe ankylostomiasis; lemon-yellow tint of face; palpitation and breathlessness, but no swelling of the legs. Heart-beats vary from about 80 recumbent to 120 standing up, and the apex beat alters its position markedly on changing his posture. A mitral murmur is audible when the patient stands; there is nothing to suggest phthisis. The abdomen shows nothing abnormal beyond some slight epigastric uneasiness on firm pressure; the right kidney is easily palpable in its lower half. The urine shows a marked brown ring with nitric acid, has an offensive, aromatic odour, and an acid reaction, but no sugar or albumin.

The patient has always been of slim build, but the ribs are prominent, the muscles poor, and there is no fat.

His weight was 99 lb., and his height 67 in.

He says he has more or less constant pain "in the heart," and is seldom able to sleep before 1 or 2 in the morning.

The stool, examined a day or two later, was dark, pasty, offensive, and showed no ova, or blood, or slime.

When we learned that he went in keenly for athletics, and as the first symptoms had come on during training, it was at first thought possible that the heart might have something to do with the condition.

As the stools remained dark ("bilious-looking"), even on a meat-free diet, the guaiacum and aloin tests were employed and blood was proved to be present. This, taken with the epigastric tenderness, and the pain (see below), justified a provisional diagnosis of duodenal ulcer.

His mode of life is that of foreigners in the East. Until recently he was attending school in Shanghai, was a great sprinter, and indulged in all forms of sport. With the exception of chronic nasal catarrh, which had lasted some years, he has had no previous illnesses.

The patient is of a nature bright, keen and intelligent above the average. A *résumé* of his account of his illness may be tabulated as follows:—

1908.—Bathing much in the hot weather in the Soochow Creek, Shanghai, close to the Markham Road Bridge. Did not drink any of the water. Almost no bathing here in 1909.

1909.—January, shooting expedition, drank foul water from a creek in the swamp above Kingkow, 15 miles above Wuchang (Hupeh).

February.—Camping out, drank water from a creek by a footpath among a lot of graves at Tanyang, and also ate ice from a pond that was used for irrigating purposes (too dark to notice this at the time, but remarked next morning).

April.—Camping, drank water from a pond in the hills near Soochow. The water had a saltish taste. Also drank water from a well at the same place.

Except for the above mistakes, he has not been specially incautious in bathing or drinking.

May.—First sign of weakness appeared as a giddiness in the first few days of running when training for the sports. This came on even after a short run. Sleep and digestion good. Nothing noted about the stools.

June.—Playing tennis every day.

July.—Since the sports he had felt fairly well, but now began to cough some very dark phlegm, although his nasal catarrh was not so bad as usual. Slight pains commencing in the stomach, and by the end of the month they became very bad at night, and he then slept very poorly.

August.—Sleeping badly, appetite poor, pains marked at night and also slightly in the daytime. Taking exercise as usual.

September.—Improvement and sleeping better, practically no pain at night and only slightly by day and not every day. Moderate exercise.

October.—Running once or twice. Digestion poor, sleep not so good as last month, stool now noticed to be unnaturally dark. Pains bad at certain hours, viz.: 10 a.m., 3 p.m., and at night from 10 p.m. to 1.30 a.m. The pain thus came on about three hours after food, at the same hour every day, and lasted strongly for an hour or so.

November.—Pains continued. All exercise stopped from this date.

December.—Digestion, sleep and pains bad. Stool dark. Unable to eat. Consulted a doctor, but no improvement followed.

No history of diarrhœa at any time.

Blood examination, February 2, 1910: Hæmoglobin (Fleischl), 58 per cent.; red cells, 2,624,000; white cells, 7,100; polymorphs, 45 per cent.; mononuclears, 40 per cent.; large hyaline, 5 per cent.: eosinophiles, 6 per cent.; mast and transitional cells, 4 per cent. No abnormal red cells. Colour index, 1·1; ratio of W.B.C. to R.B.C. 2 : 700.

Previous to this date several examinations of the stool had been made, but one day an unusually hard motion was passed with much pain in the abdomen before and after. This motion bore some blood-tinged slime on its surface, and a smear of this showed it to be crowded with the typical eggs.

*Course of the Case under Observation.*—The patient was kept absolutely confined to bed, and at first no medicines were given beyond such mild aperients as were necessary to keep the stools comfortably soft. At first the appetite continued very capricious, and as he had always been accustomed to very highly spiced food, he still demanded everything highly flavoured, and asked for, and indeed took, pickles, ginger, and sweets from time to time. A purely milk diet certainly did not agree with him, and after a week's trial it was abandoned for a rational mixed diet with no limitation as to quantity. The stools seemed to be less affected

by change in the diet than by the amount of bleeding and fermentation present at any time in the bowel.

By the end of March he ate his meals well, and in April he was carried downstairs daily and took his meals with the family. Previously to this he usually took only two meals, since if he had a good night he would not wake before 11 a.m. Sensations of nausea were not uncommon, and once every fortnight or so, he would bring up his newly-swallowed meal. Indeed, it was soon noticed that about every fifteen or twenty days the patient experienced a "set-back," and at such a time the stools became darker—almost tarry, and very malodorous, the pains stronger, sleep poor and deferred, a bad taste in the mouth, and a sallower tint of skin and mucosæ.

The differential leucocyte count at this time showed the eosinophiles to number about 10 per cent. The other cells in about the same proportions as before. The Hæmoglobin improved to 62 per cent., and the number of R.B.C. was almost normal.

The *condition in April*, 1910, was briefly thus: The stool was still darker than natural, but appetite and digestion were good except at the time of the above-mentioned relapses, and from these he would take four or five days to recover. There was very little improvement in the weight; it remained about 100 lb. He was transferred to a couch by day, but never expressed any desire to get up. Sleep was satisfactory, and night-sweats were not common, and never marked. He found his position easiest on the back or on the left side. It was only in the month of May that he began to be able to rest at night on the right side.

Pains were never long absent, and were characterized chiefly by their inconstancy as to site and duration. They were referred chiefly to the abdomen and lower rib areas, mostly about the region of the apex-beat. Most usually they came on in the evening and claimed attention until he fell asleep. They were rarely severe enough to keep him awake, except at the times when the whole disorder seemed to be exacerbated.

*At this time* also he began to complain of a sensation as if his food could not enter his stomach easily, as if it stuck at the lower end of the gullet, and remained so until it was washed on by a mouthful of fluid. But even when drinking water this sensation was noted.

Examination of the abdomen revealed very little definite; tenderness on pressure in the subcostal angle was, if anything, more marked on the right side. Occasionally there was a painful spot just above the navel (? transverse colon), and very often, especially after a firm or hard stool had been passed, the colon in the left iliac fossa was palpable like a finger, and distinctly tender.

No friction sounds were ever heard over the liver, nor was any special pain referred to the right shoulder.

There was no suspicion of free fluid in the peritoneum, and although the abdominal wall was thin, nothing certainly resembling enlarged glands could be detected.

The temperature was noted morning and evening for about three weeks at this time, and was found to be normal, occasionally rising in the evening to 99° F. He had never complained of fever at any time; the spleen could not be said to be enlarged.

The patient was peculiar in that he could not endure to be warmly clad day or night. He said it made him uncomfortable, and brought on perspiration even in cold weather, and this when his hands and feet were distinctly cold to the touch.

In *May*, 1910, the differential count was:—

| | |
|---|---|
| Lymphocytes .. .. .. .. | 43·5 per cent. |
| Polymorphs .. .. .. .. .. | 43·5 ,, |
| Eosinophiles.. .. .. .. .. | 5 ,, |
| Large mononuclears .. .. .. | 6 ,, |
| Transitionals .. .. .. .. | 2 ,, |
| No mast cells. | |
| | 100·0 |

The urine had now lost its offensive odour, but the stools remained dark, and eggs could be found at every examination.

*Conclusion.*—In June the patient was sent to the hospital in the hills at Kuling for the hot weather. He still led a sedentary life, and gained one or two pounds in weight. He suffered a rather severe "set-back," with diarrhœa towards the end of his stay, possibly due to indiscretion in diet. His condition on return in August was practically unchanged.

In September he was taken to Shanghai, and shown to a Continental surgeon there, who diagnosed tumour of the liver, and performed laparotomy. The operation showed that the liver was coarsely nodulated and adherent by its under surface to a mass of glands in the gastro-hepatic omentum. Nothing, of course, could be done, and a diagnosis of cancer of the liver was given to the parents.

The patient gradually got weaker, and died in Shanghai in November. As far as I know, no autopsy was made, which is much to be regretted. The description given of the liver corresponds well with that shown in a liver removed from a Chinaman who died in the R. C. Hospital, Hankow. This latter specimen was described by Dr. J. A. Thomson at the China Medical Missionary Conference at Hankow in February, 1910.

Case 2.—A Spanish priest arrived in Hankow on September 13, 1910, from the interior of the province of Hunan, about a fortnight's journey from Ichang. He complained of "malaria." His story was that he had always enjoyed good health, even living, as he had to do, in Chinese fashion in Chinese houses with the food of Chinese peasants. Questioned later, he admitted having bathed (? once) in a "clean" pond, the water of which, however, had a smell. In August he got a drenching in rain, and felt chilled thereafter, and the perspiration natural to the August temperature ceased. This was the onset of the fever about twenty-four days before I saw him. No thermometer was available, but the fever would seem to have been severe. He was carried on a stretcher-chair to Ichang, and sent to Hankow. Beyond a little quinine, no medicine had been taken.

When he was first seen by me the condition was: Temperature, 105°; pulse not accelerated, tongue slightly furred. The patient seemed remarkably comfortable, considering the pyrexia. He was a strongly built man of perhaps less than the average height, and aged about 40. He was inclined to make

light of his illness. Appetite good, and he expressed a desire for his ordinary diet. No wasting, but face rather sallow.

Practically, no physical signs were to be made out in chest or abdomen beyond some collections of gas in the bowel which were removed by aperients. No skin rash, nor any spots pointing to typhoid, and, indeed, his appearance was much against typhoid of the second or third week with that temperature. There was doubtful tenderness to pressure to the right of the epigastrium, but the patient declined to affirm that it was actually painful.

Although no parasites could be found in the blood-film, quinine was given in 15- to 20-gr. doses daily for four days.

The fever declined and the quinine was continued in 5- to 10-gr. dose for a fortnight. The temperature, however, never quite reached normal, although the morning temperature was usually under 98°. From 2 till 5 p.m. every afternoon there was a rise. All the time while he was under observation he found difficulty in sleeping before the early hours of the morning.

By the end of the fourth week, September 24, he insisted on getting up in the afternoons, and taking practically ordinary food.

*Condition of the Fæces.*—The first aperient brought away a large quantity of dark, bilious-looking, partly formed, very offensive material. In this there was no slime, and no blood could be made out, nor were any eggs other than a few trichocephalus ova found.

Nothing further was noted for a fortnight, when a somewhat firmer stool brought away some brown slime with it, and in this there were numerous schistosome eggs. There was no pain before or after defæcation.

Eventually, after nearly five weeks in Hankow, he returned to his station in Hunan, and the last report states that he was doing well (February, 1911). There is no particular reason why we should associate the fever in this case with the schistosoma that were certainly present, but to prove any other cause for the temperature was impossible. It was not malaria, and not typhoid, and it seems to me that even slight ulceration in the bowel with constipation and the resulting putrefaction and absorption of poisons might well explain the clinical picture.

The trematode infection was probably a slight one, and if the worms die out without leaving large deposits of eggs in the liver, there may not be anything further to report in his case.

Differential leucocyte count, September 15:—

| | | |
|---|---|---|
| Polymorphonuclears | 44 | per cent. |
| ,, coarsely granular | 36 | ,, |
| Lymphocytes | 11 | ,, |
| Mononuclears | 9 | ,, |

The coarsely granular polynuclears were probably really all eosinophiles. The Leishman stain used was deficient in eosin, and consequently no typical eosinophiles were seen. The distinction between the two forms of polynuclears was, however, extremely well-marked. The eggs were noted first twelve days later.

Three dogs ill of dysentery were examined. The disease is fairly common among sporting dogs in Hankow. No cases have yet been reported in native dogs, or in cats, or in other animals in that district. All the dogs examined had previously had the usual treatment for worms.

(*A*) B.'s dog (young Aberdeen terrier). Killed by shooting through the head, January 5, 1911. No worms were found in the intestine or in the portal vein. One *Filaria immitis* in the heart. A tumour, size of a walnut, partly an abscess, in front of the lower end of the œsophagus containing over half a dozen *Spiroptera sanguinolenta*. No free fluid in the abdomen. Peritoneum apparently healthy. Liver surface smooth, but showing numerous small yellow spots (eggs). Bowel healthy except for an acute inflammation of the lower six inches of the large bowel. Stool gelatinous and bloody, and full of schistosome eggs. Dr. Leiper reported the eggs to be of the usual type.

(*B*) P.'s dog (pointer). Killed January 11, 1911. About half a dozen filaria in the right heart. Tumour, size of a hazelnut, opening into the middle of the œsophagus containing pus and a nest of worms (Spiroptera). No free fluid in the peritoneum. Liver covered with small, faint yellow spots (eggs). No worms in the intestine. The mucosa of small and large intestine was inflamed, worst in the segments corresponding to the masses of enlarged mesenteric glands — especially lower ileum and cæcum, and appendix. At these parts the mesenteric attachment to the bowel was widened out, and thickened into a row of tuberosities, each of about the size of a pea. On holding the mesentery up to the light many schistosomes could be seen in the portal veins. There were several hundred worms—the males measuring about $1\frac{1}{2}$ cm. in length, and the females about $2\frac{3}{4}$ cm. Stool almost black, slimy, and containing abundant eggs, whose dimensions averaged ·085 by ·067 mm. to ·094 by ·085 mm.

(*C*) S.'s dog (fox terrier). Died February 5, 1911, after several months bad dysentery and emaciation. The same three helminths were also present in this case, and the large bowel was severely inflamed from end to end. Numerous schistosomes in the portal veins.

## Conclusions.

(1) From a consideration of cases of this disease met with in Hankow, in Chinese, and also of the two cases reported herewith, the writer inclines to the belief that in early or mild infections there are no certain symptoms or signs by which we can definitely diagnose the disease. It is probable that not merely may the eggs in the fæces be scanty and infrequent, but that in mild cases they may be absent for long intervals. (See Tsuchiya's paper for an account of the manner in which the eggs are deposited and the primary situations involved.)

(2) Gross lesions (nodular liver, enlarged spleen, ascites, and long-continued passage of foul, slimy, undigested stools) are to be expected in advanced cases, in heavy infections, in poorly fed and hard-worked natives. But we must be chary of looking for such symptoms in better-class patients and in foreigners.

Moreover, we must keep in mind that most cases of the disease that come to mission hospitals in China

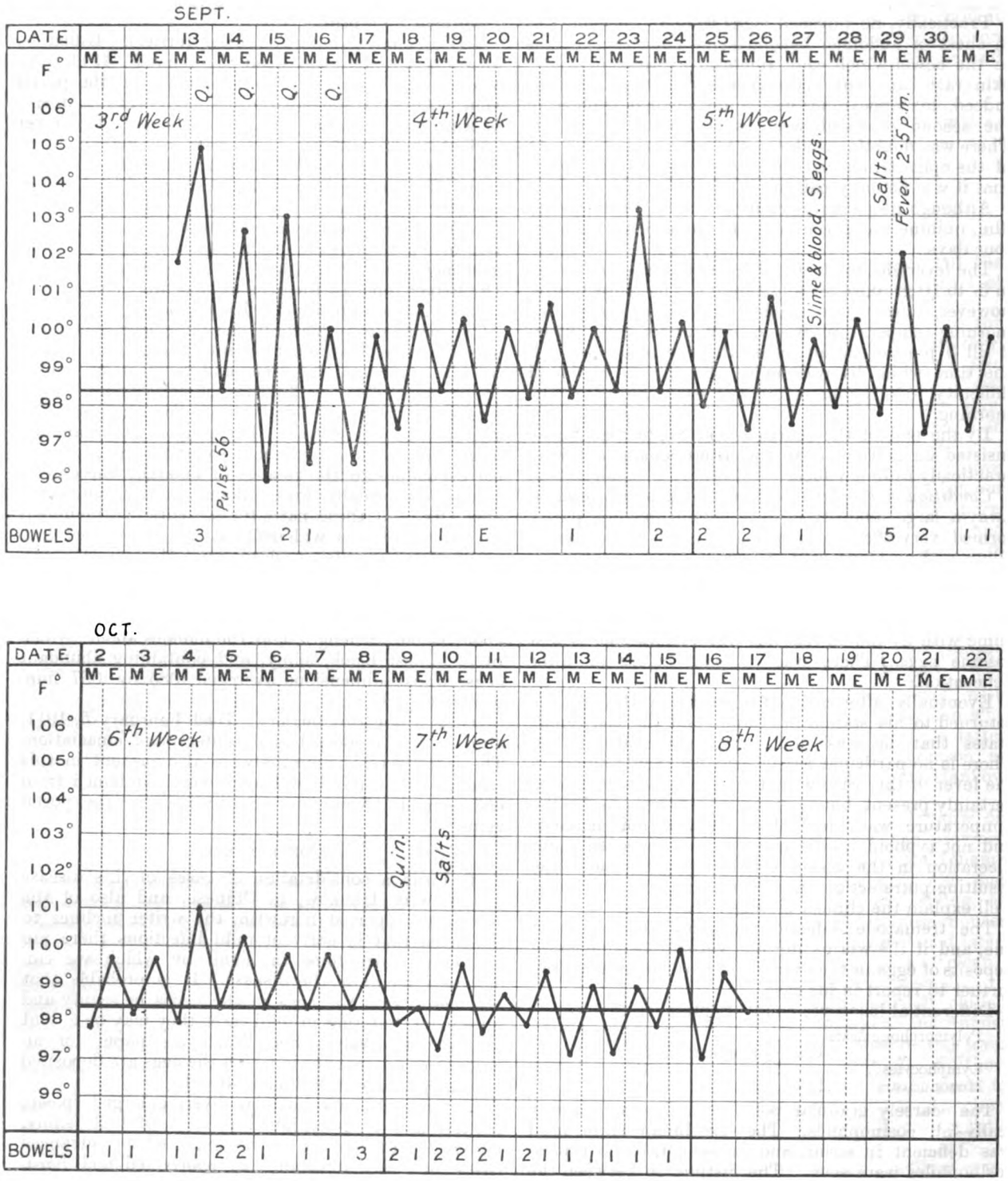


Chart of Case 2.—*Schistosomum japonicum* infection.

have, or have had, also other intestinal and blood parasites (helminth and protozoal). Further ordinary hepatic cirrhosis is far from uncommon at any rate in the district around Hankow. (In an autopsy on such a case I have failed to find evidence of any parasites or ova whatsoever after sectioning and examining microscopically liver, spleen, omentum, mesenteric glands, and portions of small and large intestine.)

(3) In this disease there seems to be no one type of clinical picture. Of many symptoms one or more may be in evidence, but varying from time to time—nausea, flatulence, pain after food, "painful hunger," sleeplessness, weakness, languor, anæmia, colic, epistaxis, recurrent dysentery, &c. Jacksonian epilepsy has been reported, but I have not seen it. Nor have I noted diminished reflexes. To what extent pyrexia and erythema or urticaria form part of the symptomatology is uncertain. True icterus is uncommon. It should be noted that ascites may result not merely from fibrosis in and about the liver, but also from endophlebitis and thrombosis in the portal veins.

(4) The disease is widely different clinically from the Egyptian Schistosomiasis, and deserves a fuller description than that commonly given in text-books. The eggs may evolve any part of the digestive tract below the diaphragm, including apparently invariably the liver. The worms have never been proved to exist outside the veins, and usually are confined to portal veins. Cases where adult worms have been found in the iliac and pulmonic veins are recorded.

(5) Prophylaxis as regards native labourers seems to be out of the question in a province like Hupeh where the land is so widely inundated annually.

(6) Animals known to be infected should be destroyed wherever possible.

(7) As Logan points out, foreigners in the Yangtse valley should be warned to be most careful as to where they bathe, since the balance of evidence at present points to the cutaneous mode of infection.

It seems likely that over the vast area of Central China there are relatively few districts where the water is infected, but the disease has been reported from several provinces of China, so that it may prove to be much more prevalent than is now suspected in the East.

(8) With the increasing trade and traffic facilities in the Yangtse valley the endemic areas may increase, and more cases may be found every year.

(9) While the disease, as Tsuchiya points out, is not necessarily immediately or even remotely fatal, it is a very disabling disorder, and patients of the most infected class are only too liable to be reinfected.

(10) Doctors attending patients from the Far East must bear this disease in mind, and, if examination of the fæces be negative in any obscure abdominal condition, the presence of eosinophilia should suggest repeated search for the ova.

The following are some of the most important papers that have appeared on the subject:—

[1] KATSURADA. *Annotationes Zoologicæ Japonenses*, vol. v, Part iii, 1904. The first paper giving a full description of the parasite.

[2] *Idem. Centralbl. f. Bakteriologie* (Originale), Bd. 53, February 1910. Giving the evidence (experimental) for infection through the skin.

[3] CATTO. *British Medical Journal*, No. 2297, 1905. *Post-mortem* appearances in a Chinaman.

[4] BEYER. *American Medicine*, vol. x, p. 578, 1905. Dr. Logan's case in a Chinaman at Changteh, Hunan.

[5] STILES. *Ibid.*, vol. ix, p. 821, 1905.

[6] LOOSS. *Centralbl. f. Bakteriologie* (Originale), vol. xxxix, p. 280. 1905.

[7] SCHEUBE. *Archiv. f. Shiffs und Tropen-Hygiene*, vol. ix, p. 150, 1905.

[8] WOOLEY. *Philippine Journal of Science*, vol. i, No. 1, 1906. Case of a Philipino; also a staining method for the eggs in sections.

[9] TSUCHIYA. *Virchow Archiv.*, vol cxciii, pp. 323-369, 1908. A very full account of the pathology of the disease, and a report of a series of cases in Japan.

[10] MANSON. *Journal of Tropical Medicine and Hygiene*, November 16, 1908. Mention of a case (suspected) in a European.

[11] PEAKE. *Ibid*, March, 1909. Full report of three cases in Chinese in Hunan.

[12] LOGAN. *China Medical Journal*, March, 1911. Notes on an infected boy, native of North America.

[13] WILLS. *Ibid*, March, 1911. Notes on Chinese out-patients with the disease.

[14] LEIPER. *Transactions of the Society of Tropical Medicine and Hygiene*, March, 1911. Showing that the ova have spines.

## *SCHISTOSOMUM JAPONICUM* DYSENTERY IN AN AMERICAN CHILD.

By O. T. LOGAN, M.D.

*Medical Missionary, Changteh, Hunan, China.*

WHILE at Kuling, a mountain resort near Kiukiang, last summer, I was called upon to treat the 13-year-old son of a missionary stationed near Yochow, Hunan. He was apparently suffering from ordinary dysentery in the subacute stage. As is my custom in all disorders of the intestinal tract, I made a microscopic examination primarily to endeavour to ascertain whether the boy had amœbic or bacillary dysentery. To my surprise, every field of the microscope was well sprinkled with eggs of *Schistosomum japonicum.*

Upon questioning the parents it was found that the boy had been in the habit of wading barefoot in the ponds and Tong Ting Lake since the summer of 1908, and that in the latter part of that summer he had an attack of fever with slight bloody movements that were not regarded seriously. During the early part of this fever he was afflicted with giant urticaria which was regarded as angio-neurotic œdema. This is noteworthy, as Lambert, of Kiukiang, reported in *The China Medical Journal* last year (unfortunately most of my copies of this publication for 1910 have been destroyed, so I cannot give the exact reference), a peculiar fever that was accompanied by cutaneous symptoms similar to those of the case in hand. This fever always followed after patients had spent some time shooting in the swamps around Kiukiang, which are now known to be infested with *S. japonicum.* Only those who waded barefooted were affected. Houghton, of Wuhu, first suggested the probability that the wading fever reported by Lambert might be the first stage of schistosomum infection.

It will be interesting to hear further reports from these wading fever cases, as doubtless we shall within the present year.

On September 3, 1910, a blood count of our patient showed :—

| | | |
|---|---|---|
| Eosinophiles ... | ... | 20 per cent. |
| Polynuclears ... | ... | 48 ,, |
| Large mononuclears ... | ... | 16 ,, |
| Small ,, ... | ... | 16 ,, |

Number of cells counted 350. Mononuclears larger than the average polynuclear cells were classed as "large."

There can be little doubt that this child was infected either through his skin or mucous membrane, as there is not the slightest probability that he ever drank any water that had not been boiled. This coincides with Katsurada's findings in Japan. He writes (*Centralb. f. Bakt.*, February, 1910) that he failed to infect cats with *S. japonicum* by feeding, but could infect cats and dogs heavily with one and a half hours immersion in infected fields. In this connection it is worth mentioning that it is impossible to keep foreign-bred dogs in Kiukiang as they all sooner or later contract this disease. I examined the stools of a fox terrier that was reared in Hankow last year, and found that the eggs of the fluke under discussion were abundant.

A full report of our American boy's case will appear in an early number of *The China Medical Journal*. At present he is in his native land and is reported to be in fair health. He is under the care of well-known physicians who will doubtless report the case later.

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## DRUGS AND DRUG HABITS IN BURMAH.

By Lieutenant-Colonel R. H. Castor, I.M.S.

While in charge of the Rangoon Central Jail I saw a great deal of prisoners addicted to the use of drugs and thought it would be interesting to discover the proportion of prisoners who used the same, and the favourite drugs resorted to by them. The result of my investigation is given in this paper.

The classes I have divided them into are: (*a*) The convicted; (*b*) those under trial; and (*c*) civil prisoners.

(1) *Convicted Class.*—Of this class the great majority (more than 90 per cent.) were Burmans. Of 1,885 admissions, 512 were addicted to drugs in this proportion :—

| | |
|---|---|
| Opium eaters | 193 |
| Alcohol (beer, whisky, &c.) | 130 |
| Morphia injectors | 85 |
| Opium smokers | 50 |
| Opium eaters and morphia injectors | 17 |
| Toddyists (native liquor) | 10 |
| Cocaine eaters | 6 |
| Opium eaters, morphia injectors and alcoholists | 6 |
| Opium and cocaine eaters | 4 |
| Morphia injectors and cocaine eaters | 4 |
| Opium smokers and alcoholists | 2 |
| Opium smokers, morphia injectors and cocaine eaters | 2 |
| Seinyaists (native liquor) | 2 |
| Gunga eater | 1 |
| Total | 512 |

(2) *Under Trial Class.*—There were 945 admissions of this class and 172 were addicted to drugs in the following order :—

| | |
|---|---|
| Morphia injectors | 51 |
| Alcoholists | 40 |
| Opium eaters | 28 |
| Morphia injectors and morphia eaters | 23 |
| Opium smokers | 7 |
| Morphia injectors and cocaine eaters | 6 |
| Cocaine eaters, morphia injectors and opium eaters | 4 |
| Morphia injectors and alcoholists | 4 |
| Opium eaters and smokers, and morphia injectors | 3 |
| Opium eaters and alcoholists | 2 |
| Cocaine eater | 1 |
| Opium eater and cocaine eater | 1 |
| Opium eater and smoker | 1 |
| Alcoholist and cocaine eater | 1 |
| Total | 172 |

(3) *Civil Class.*—This class of prisoners were in jail for being unable to pay their debts. There were 158 admissions during these months and 8 of them were addicted to drugs :—

| | |
|---|---|
| Opium eaters | 3 |
| Alcoholists | 3 |
| Opium eater and morphia injector | 1 |
| Toddyist (native liquor) | 1 |
| Total | 8 |

Of the *one drug* class there were six divisions :—

| | |
|---|---|
| Opium eaters | 224 |
| Alcoholists, including native liquor | 186 |
| Morphia injectors | 136 |
| Opium smokers | 57 |
| Cocaine eaters | 7 |
| Gunga eater | 1 |
| Total | 611 |

Of the *double combination* there were nine divisions :—

| | |
|---|---|
| Morphia injectors and eaters | 23 |
| Morphia injectors and opium eaters | 18 |
| Morphia injectors and cocaine eaters | 10 |
| Opium and cocaine eaters | 5 |
| Morphia injectors and alcoholists | 4 |
| Opium eaters and alcoholists | 2 |
| Opium smokers and alcoholists | 2 |
| Opium eater and smoker | 1 |
| Alcoholist and cocaine eater | 1 |
| Total | 66 |

Of the *triple* combinations there were four divisions :—

| | |
|---|---|
| Opium eaters, morphia injectors and alcoholists | 6 |
| Opium smokers, morphia injectors and cocaine eaters | 4 |
| Opium smokers, opium eaters, and morphia injectors | 3 |
| Opium eaters, morphia injectors, and cocaine eaters | 2 |
| Total | 15 |

T e following conclusions may be drawn from these facts :—

(*a*) The first division may be called the criminal class, the second the doubtful class, and the third the more respectable class.

(*b*) Opium eaters are the most numerous in the first class, morphia injectors in the second class, while opium eaters and alcoholists share the first place in the respectable class.

(*c*) Of the *total* number of admissions, (2,988), 692 or 23 per cent. were addicted to drugs.

(*d*) Of the convicted class out of 1,885 admissions 512, or 27 per cent. were accustomed to drugs.

(*e*) Of the under trial class, there were 945 admissions and 172 were druggers, or 18 per cent.

(*f*) Of the civil class (158), 5 per cent. were disposed towards drugs.

(*g*) That the drug habit is far more prevalent in the criminal classes than in the respectable class, the doubtful class standing, as was expected, between.

(*h*) Analysing the total inclined to drug habits, 88¼ per cent. relied on one drug, 9½ on two drugs, and 2¼ per cent. on three drugs.

(*i*) Analysing the drugs individually, 71 per cent. took opium in some form or other, 29 per cent. took alcohol, and 4 per cent. relied on cocaine, while only one (and he was an Indian) took to gunga.

(*j*) That opium eaters and smokers came to 324, whilst morphia injectors came to 206, whereas in Europe morphia injectors constitute the larger number.

I have not taken into account *tobacco* as it is generally consumed, and is used for chewing, smoking, and sometimes for snuffing. The percentages will probably be 90 per cent. for smoking, 25 for chewing and 5 for snuffing.

In all these cases the drug habituation had a tendency to grow and in some cases the dose taken was very large, but I regret I cannot give the exact amount taken of each of the drugs. The largest amount of opium consumed in a day was about 250 grains.

With regard to the habituation of these drugs it was difficult to find out how they first arose, or at what age the habit commenced. A good many said it was due to association, others to ward off pain and sickness, and others to the singular excitant effect produced. What part heredity plays is not well understood, but Brouardel states that the "morphinist father tends to beget children whose vitality is from the beginning not only seriously impaired but specifically biassed." Again, Sainsbury in his excellent work on "Drugs and the Drug Habit" states that "it has been established that the unborn child may acquire the habit from the mother." The opium habit in a good many cases undermined the health of the persons using the same, while their skin was often covered with signs of the needle pricks, which sometime resulted in subcutaneous abscesses. The effects of alcohol are so well known that they are not alluded to here. Cocaine was apparently resorted to for its effects in small and medium doses at first, but "with use a rapid tolerance is effected," and the doses then soon rose. Sainsbury states "it is not uncommon for the cocaine habit to exist along with the morphia or alcohol habit, the cocaine having been introduced in the vain hope of breaking the one or other habit already acquired." From a reference to the figures it will be seen that opium, including morphia, was combined with cocaine in 21 cases, while alcohol and cocaine were combined only in one case, but I cannot say how far it was introduced with the "vain hope" mentioned. I did not see any marked effect on the health of the persons devoted to cocaine; this was partly due to the comparatively short time the drug has been used, partly to the doses not being very large, and partly to the small number disposed towards this drug.

Those more interested in this subject should consult Sainsbury's book on the prevention and curative treatment of these habits; but I may add that with regard to the opium habit, in the great majority of cases the drug was withheld as soon as the prisoner was admitted into the jail, and a cure was effected in this way. In other cases the health was so undermined that the prisoner had to be admitted to hospital for treatment, and the dose of the drug gradually diminished, and a cure was finally established provided he was a long termer. In very few of the cases did the patient actually succumb to the effects of the drug alone in spite of treatment. As a rule 10 to 15 per cent. of the total mortality occurred in those addicted to the use of opium.

### "The Indian Medical Gazette," February, 1911.

Major Wall, I.M.S., describes cases of sand-fly fever in Chitral occurring amongst members of the Chitral Relieving Force between the dates of October 5, 1909, and October 7, 1910. The fever was endemic in Chitral during the hot season (May to September), and the general characters of the disease were identical with those of sand-fly fever in other countries. Two species of *Phlebotomus* were present—*pappatasi* and *babu*—these being very abundant in the fort at Drosh, where many of the cases originated.

### "The Journal of the American Medical Association," March 25, 1911.

Nice, McLester and Torrance describe three cases of pellagra treated with salvarsan (606). Early and material improvement seemed to follow the administration of the drug. After a week had elapsed, in the case of two female negroes with well-marked pellagra, for example, the skin lesions had changed materially, as had the ptyalism, vaginitis, weight and mental symptoms. Both were eating heartily, the diarrhœa had abated, and constant improvement was recorded. It is too early to say positively yet what effect the drug will have, but the final results, deductions, photographs, and later cases will be embodied in a future report by the authors above mentioned.

### "Medical Record," March 18, 1911.

Abbe reports two cases of ainhum in two negresses from the District of Columbia. Thirty cases in all, he states, have been reported from the United States, mostly from the Gulf States and the Carolinas, some of these, however, being of doubtful origin. The two cases described resemble those seen so frequently on the West Coast of Africa. Abbe believes that in view of the fact that the bony atrophy (seen by skiagraphs) preceded proximal to the groove, it would seem as if there were some general cause arising nearer to the trunk for the atrophy and auto-amputation, and that the loss of the toe is not the essential lesion in the process, but merely the result of some other lesion. He believes that the primary lesion is a trophoneurosis.

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# Tropical Medicine and Hygiene

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## THE FAR EASTERN ASSOCIATION OF TROPICAL MEDICINE.

THE second biennial Congress of the Far Eastern Association of Tropical Medicine will be held in Hong Kong in January, 1912. The proceedings will occupy a week, from January 20 to 27. The interest and importance attaching to this meeting will no doubt prove attractive to all medical scientists and practitioners in the tropics in every part of the world, and distance alone will prevent them fulfilling their desire to be present. The immediate area from which the Association derives support is so extensive, however, that a large attendance is assured, for from Japan in the north to Java in the south and Ceylon to the west a host of enthusiasts in their profession will be present.

The distances from which members will gather are, viewed from a European standpoint in like circumstances, well calculated to astonish one; and the variety of races and peoples from which the medical men who will attend the meeting derive their information and knowledge is without parallel in any "local" association in the world. A list of the Vice-Presidents of the Association suffices to indicate how widely divergent these races and peoples are. Ceylon with its Singhalese and Tamils, the Straits Settlements with its varied population, amongst which the Malay predominates, the Javanese, the Siamese, the Filipinos, the interesting inhabitants of Annam, Cambodia, and Borneo, are a few of the peoples to the south and west of Hong Kong which these Vice-Presidents represent; whilst from China, Formosa and Japan no doubt many medical men will assemble at the "Clapham Junction" of the Far East, as Hong Kong is sometimes styled by English folk.

In Hong Kong there is also a wealth of clinical material ever to hand which will provide ample opportunities for study and observation. The nucleus for a large audience at these meetings is provided by Hong Kong itself, for some fifty medical men are constantly at hand, including representatives of the Navy, the Army, the Colonial Service, the private practitioners and the medical officers on board passenger and other merchant vessels which happen to be in port at the time of the meeting. These will be joined by many from afar; for all men practising tropical medicine are enthusiastic in their work, stimulated no doubt by the fact that the study of tropical medicine has brought new life into medicine as a whole, and, that through the lessons it has taught, many additions to our knowledge have been made in countries beyond the Tropics which would otherwise have lain dormant. The summons to the Congress is published in English, French, and German in the following terms:—

FAR EASTERN ASSOCIATION OF TROPICAL MEDICINE.

*Second Biennial Congress, Hong Kong, January* 20 *to January* 27, 1912.

*President*:—J. Mitford Atkinson, M.B., D.P.H., Hong Kong.

*Vice-Presidents*: W. G. Ellis, M.D., (Straits Settlements); J. de Haan, M.D. (Java); Victor G. Heiser, M.D. (Philippine Islands); H. Campbell Highet, M.D., D.P.H. (Siam); Neil Macleod, M.D. (Shanghai); Sir Allen Perry, M.D., D.P.H. (Ceylon); Professor G. Shibiyama, M.D. (Japan); J. Staby, M.D. (Tsingtau); Professor Yersin, M.D. (French Indo-China).

The Second Biennial Congress of this Association will be held in Hong Kong from Saturday, January 20 to Saturday, January 27, 1912, and you are cordially invited to attend and to take part in the work of the Congress. The Association is an international one formed to promote the science and art of Tropical medicine in the Far East.

The fortnightly French mail steamer from Ceylon, Singapore and Saigon is due to arrive in Hong Kong on Tuesday or Wednesday, January 16 or 17, and the fortnightly English (P. & O.) mail steamer from Ceylon, Penang and Singapore is due to arrive on Friday, January 19, while there are several mail steamers arriving in Hong Kong each week from the North.

Saturday, January 20, will be devoted to the reception of official delegates and visitors, leaving the whole of the following week for the scientific work of the Congress.

A scientific committee has been appointed consisting of: Colonel W. G. Bedford, C.M.G., M.B., P.M.O., *Chairman*; Deputy Inspector General J. L. Barrington, R.N.; Charles Forsyth, M.D., F.R.C.S. (Edin.); Oskar Muller, M.D. (Munich); F. Osmund Stedman, M.D. (Lond.); to classify the papers which

are offered, so as to give, as far as possible, a day to each of the following groups of subjects:—Protozoology, Helminthology; Cholera, Plague, Leprosy, Tuberculosis; Tropical Fevers, including Malaria, Beri-Beri, Dysentery; Surgery, Obstetrics, Infantile Diseases; Climate, Hygiene, Sanitation.

It is requested that a brief abstract of each paper be forwarded as soon as convenient, for the information and guidance of this Committee. Papers may be read in either English, French, or German, but authors are asked to send their abstracts in English in all cases.

The subscription to the Association is 10s. 6d. ($6 Hong Kong currency), and is due now (1911), but no further subscription will be required until 1913.

A suitable social programme will be arranged for the entertainment of visitors during the Congress.

The average temperature in Hong Kong during the month of January is about 62° F. (17° C.), while its range may extend from 80° F. (27° C.) on a warm day to 40° F. (4·4° C.) during a cold night, so that visitors from more tropical regions should provide themselves with warm clothing.

All communications to be addressed to Francis Clark, M.D., M.R.C.P., D.P.H., Secretary-Treasurer-General.

*Hong Kong*,
*March* 7, 1911.

## Notices.

### BRITISH MEDICAL ASSOCIATION.

SEVENTY-NINTH ANNUAL MEETING, BIRMINGHAM,
July 25, 26, 27, and 28, 1911.

SECTION OF TROPICAL MEDICINE.

*President*: SIR FRANCIS LOVELL, C.M.G., F.R.C.S., Dean of the London School of Tropical Medicine, Royal Albert Docks, London, E.

*Vice-Presidents*: Dr. A. G. BAGSHAWE, B.A., M.B., B.C., and D.P.H.(Camb.), Director of the Sleeping Sickness Bureau, Royal Society, Burlington House, London, W.; Dr ANDREW BALFOUR, M.D., C.M., B.Sc., D.P.H., F.R.C.P., Director of the Wellcome Research Laboratories, Gordon College, Khartoum, &c.; Dr. R. T. LEIPER, M.B., Ch.B., F.Z.S., Helminthologist, London School of Tropical Medicine.

DEAR SIR,—The Section of Tropical Medicine will meet on Wednesday, Thursday, and Friday, July 26, 27, and 28, 1911, from 10 a.m. to 1 p.m., under the Presidency of Sir Francis Lovell, C.M.G., Dean of the London School of Tropical Medicine, when it is hoped that you will be able to be present and take part in the work of the meeting.

The following subjects have been selected for discussion:—

Wednesday, July 26, 10 a.m.—"Plague—in its Endemiological and Epidemiological Aspects."

The discussion will be opened by Dr. C. J. Martin, F.R.S., Director of the Lister Institute of Preventive Medicine; Member of the Advisory Committee for Investigating Plague in India.

Thursday, July 27, 10 a.m.—"Yellow Fever on the West Coast of Africa."

The discussion will be opened by Professor Sir Rubert William Boyce, M.B., F.R.S., Dean of the Incorporated Liverpool School of Tropical Medicine.

Friday, July 28, 10 a.m.—"Sanitation of Villages and Small Towns in the Tropics, with Special Reference to Efficacy and Cheapness."

The discussion will be opened by Dr. W. J. Ritchie Simpson, C.M.G., F.R.C.P., Professor of Hygiene, King's College, London; Lecturer on Tropical Hygiene, London School of Tropical Medicine.

In view of the lively debates which the three subjects selected for discussion may be expected to elicit, there will probably be less opportunity than usual this year for papers on miscellaneous subjects. Such as are approved by the Committee of reference for the Section will be read, so far as time permits.

It will greatly conduce to the success of the Meeting if members will kindly notify as soon as possible whether they propose to take part in the discussions, or wish to make any communication to the Section.

Any such communication must not occupy in reading more than fifteen minutes (about 1,500 words), and, for profitable discussion, it should be given the following form:—

(1) A definite statement of what it is intended to state, suggest, or prove; (2) A statement of the facts or arguments on which such thesis rests; (3) A very brief summary of your leading points.

The attention of Members is also drawn to the Regulations for the conduct of the Sections, and especially to the necessity of sending short abstracts of all communications, as discussion is thereby much facilitated.

It must also be pointed out that papers cannot be "taken as read." If not read, they form no part of the proceedings of the Section. If you are unable to be present, your paper will be read for you by one of the Secretaries.

The Museum Committee will be glad to receive pathological specimens, microscopic preparations, drawings or photographs of any subject connected with Tropical Medicine.

As a matter of convenience it was suggested that—Members resident at home, or connected with India, or the East, should address themselves to Dr. Leonard G. Parsons; Members connected with the West Indies, or America, to Dr. K. S. Wise; and members connected with the Mediterranean, or Africa, to Mr. Henry Curtis.

We are, dear Sir,

Your obedient servants,

LEONARD G. PARSONS, M.D., B.S., M.R.C.P., 52, Newhall Street, Birmingham.
K. S. WISE, M.B., B.S., B.Sc.(Lond.), D.P.H., Royal Societies Club, 63, St. James's Street, London, S.W.
HENRY CURTIS, F.R.C.S., 59, Harley Street, London, W.
*Hon. Secs.*

## Abstract.[1]

### "MOSQUITOES AND FLIES IN RELATION TO THE TRANSMISSION OF LEPROSY."

By Donald H. Currie.

In the nodular form of leprosy when fully developed there is a disease characterized by the appearance, in successive crops, of lesions of the skin varying in size from that of medium-sized papules to large nodules, and, by the coalescing of such lesions, massive and diffuse areas of infiltration.

These lesions are most apt to be located on the exposed surfaces, and especially on the face.

When an investigator punctures such a lesion and exerts pressure on the surrounding tissue, the mixture of blood and lymph thus obtained is usually, practically always, rich in lepra bacilli.

In the mosquito we have an insect that has a wide range of distribution and is often abundant. This insect feeds by puncturing the skin wherever uncovered, but more often on the face, and fills itself with blood. It later bites another person, who often crushes the blood-filled insect and thus smears the blood contained in the insect upon his own skin; this act is followed by rubbing and scratching the site of the puncture.

Thus we see that the mechanism is complete for the occasional transfer of a leper's *blood* to the skin of a healthy person, and by scratching and its accompanying trauma such blood is sometimes rubbed into hair follicles or even into the lymphatics. Whether the blood that the insect has imbibed from a leper contains the bacilli, and whether such bacilli if imbibed remain in the insect a reasonable length of time, are questions the answer to which determines whether the mechanism for the transfer of the bacillus of leprosy from afflicted to healthy persons is or is not complete.

To determine this was the object of this investigation. It must be borne in mind, however, that even if it can be shown that the bacilli are thus transferred there still remains a doubt as to whether this constitutes a means of infection. We shall not deal with that point; in our present state of knowledge only human inoculations could determine it. A hasty review of the literature upon that phase of the subject of transmission shows some forty-odd cases of alleged human inoculations, mostly on or under the skin, with but a single, doubtful, case of infection following (Arning's case), the other inoculated persons not developing the disease.

The only phase of the subject we are dealing with here is, do mosquitoes contain lepra bacilli when allowed to feed, under natural conditions, upon the skin of lepers presenting many lepra nodules? If they do contain the bacilli, then the mechanism for the transfer of the bacilli is complete, and the insect *may* be a factor in the transmission of the disease. If it does not contain them, then this insect can be excluded as a factor in the transmission of this disease.

In considering this subject we are aware of the fact that no amount of negative evidence absolutely answers the question, "May it not sometimes occur?" but from the incidence of the disease at certain times, and in certain places, we know that some well-defined and frequently acting mechanism or mechanisms exist for its transfer, and we seek to discover if this insect is one of these. The eradication of infectious diseases must rest upon the discovery of the *usual* means of transmission, and rare or accidental means are of no practical importance.

From the above it would appear, upon theoretical grounds, that the transfer of the bacilli is probable; a disease characterized by bacilli-filled lesions on exposed surfaces, together with the well-known habits of this insect of imbibing blood from the skin of such exposed surfaces, would easily explain the fact that this insect fell under suspicion as a means of transmission. But it must be remembered, also, that although the investigator finds bacilli in the blood obtained from puncturing a lepra nodule, this insect employs a similar but not identical method of blood abstraction.

#### Preliminary Remarks.

Dr. Currie obtained the following data from work performed at the laboratory for the investigation of incipient cases of leprosy at Honolulu, being a branch of the United States leprosy investigation station at Kalawao, Molokai. He goes on to say that the portion of Honolulu where this branch laboratory is situated is infested with the *Culex cubensis* throughout the year, but in his experience in the autumn and winter the *Stegomyia callopus* is rare in this exact locality, while the *S. scutellaris* has not been observed there by him.

These three varieties are the only mosquitoes known to exist on these islands. The above facts account for all the mosquitoes examined being of one species. During these experiments we succeeded in securing only three individual specimens of *S. callopus;* these we had intended to utilize by having them bite leper's nodules, but administrative duties made it necessary for us to go to Molokai, and for this reason the three were used for another purpose, to be described later.

Arriving at Molokai station, we discovered that owing to the cooler temperature and high winds of this time of the year no mosquitoes were procurable, so decided to publish the data already obtained, and later to report upon the contemplated work of having caged mosquitoes bite a large number of leprous nodules.

The necessity of obtaining the *Stegomyia* in this latter work is due to the fact (observed here by Brinckerhoff) that this *Culex* will not bite when confined to a small space, and in order to force the insect to feed upon a nodule confinement to a large test-tube or wide-mouth bottle is necessary.

[1] Treasury Department: Public Health and Marine Hospital service of the United States. Public Health Bulletin, No. 39, Studies upon Leprosy. IX. Mosquitoes in relation to the transmissicn of leprosy. X. Flies in relation to the transmission of leprosy. By Donald H. Currie, passed Assistant Surgeon and Director Leprosy Investigation Station. Washington, 1910.

### Preliminary Work.

Our first object was to ascertain whether mosquitoes, when captured in a locality in which there was no possibility of their having fed upon lepers, contained acid-fast bacilli of any kind in their intestinal tracts; also whether they showed anatomical structures which might from shape and staining reaction be mistaken for acid-fast bacilli.

With this object in view we obtained twenty-one specimens of *C. cubensis* from a non-infected district, some of these having fed upon the healthy occupants of the house in which they were captured.

The abdomen was cut from the thorax and opened, and the intestines and their contents crushed and smeared upon a glass slide. This preparation was then air-dried, stained from three to five minutes in Ziehl-Nielson carbolfuchsin, washed in water, treated with 1 per cent. nitric acid in 70 per cent. alcohol for ten seconds, washed again in water, dried, and examined with the 1 in 12 oil immersion lens (Zeiss).

This method of examination was employed in all of the insects mentioned in this publication, and so will not be referred to again.

The examination of the twenty-one insects mentioned showed no acid-fast bacilli or bacteria of any kind.

Numerous fibrils, varying in shape, size, and appearance (broken bits of the scales that cover parts of the insect) were noted as holding their stain against acid alcohol. These structures for the most part could be differentiated at a glance upon size and shape alone, but occasionally it was observed that small broken fragments required careful observation before passing them by; however, we saw no structure which a reasonably experienced person should mistake for an acid-fast bacillus.

Hoping to secure a method that would deprive these structures of their acid fastness without robbing the lepra bacillus of its colour, and thus rule out even this very slight source of error, we took smears of human and rat lepra bacilli and smeared mosquitoes over them (these insects not being included in the twenty-one mentioned), after which these slides were dried, fixed, and stained.

These were treated with many stains and mordants, with the results that while an occasional slide was secured in which the bacillus was brilliantly red while the structures mentioned had as different a colour as blue black, the rule was failure, these structures being nearly as acid-fast as the bacilli themselves. The most practical point learned was to avoid staining the slide longer than absolutely required (three minutes), as the bacilli acquired the stain somewhat quicker than the scales did.

While not "preliminary work" in one sense, as it was the last work performed, the experiment about to be described properly belongs under this designation.

We sought for an explanation of the statements of Ehlers and Bourret that mosquitoes drawing blood from a bacilli-filled nodule did not contain the bacilli in their blood-filled intestines. If this observation were correct, then there seemed to be but two possible explanations:—

(1) That the bacilli were not contained in the fluid that the mosquito drew, even though the investigators in attempting to imitate the mosquito, drew the fluid from the same nodule.

(2) That the bacilli are rapidly destroyed in the intestinal tract of the mosquito.

Any filtration process could be excluded, both from the anatomy of the mosquito and from the fact that blood corpuscles passed into the insects' intestinal tracts without difficulty.

While to us the second supposition seemed quite improbable, it was considered advisable, if only to exclude it, to make the following test:—

The three *Stegomyia* referred to were placed in separate cages and given a fluid composed of rabbit serum, sugar, and water, and containing in suspension a grass bacillus, which in size and acid fastness closely resembled the bacillus of leprosy. Of these insects two refused to feed, the third lit near the margin of the fluid and twice dipped the end of its proboscis into it, exhibiting the corkscrew motions of its abdomen that indicated that the insect was feeding.

One hour after this act the insect was killed with chloroform and removed from its cage, its body was washed and the abdomen separated from its thorax and its abdominal contents smeared upon a slide and stained by the method above described. Examination showed a considerable number of typical acid-fast bacilli in its intestinal contents, forty-five being counted in seven fields; no other bacteria were demonstrated by the methylene blue counter-stain. The experiment is to be repeated with lepra bacilli, and will appear in a future publication.

### Search for the Bacillus of Leprosy in Blood-filled Mosquitoes that probably had fed upon Lepers.

We secured thirty-four blood-filled specimens of *Culex cubensis* caught on a screen door at the entrance to the Kalihi receiving station for lepers. In this compound there were about twenty lepers, showing nerve, tubercular, and mixed forms of the disease. Several healthy persons also resided in this compound. The screen door mentioned was a few yards from the patients' sleeping rooms, which were not protected by screening. These insects had probably fed upon some of these lepers, but on which cases, and therefore which type of the disease, was not ascertainable. The examination was made only because the insects were at hand and a possibility of securing positive results existed.

The results, however, were entirely negative, and therefore, owing to the uncertainty of the source of the blood, they are only of slight value.

### Search for *Bacillus lepræ* in Blood-filled *Culex cubensis* that had fed upon Lepers.

These insects were captured early each morning from the rooms of lepers; some of these rooms were occupied by one, and some by two lepers; the condition of the occupant or occupants of each room is described below. The letters given the rooms are our own, and are for purposes of designation and convenience.

The probability of any of these insects having fed upon non-leprous persons is too slight to be considered. The probability of any appreciable percentage of them having fed upon lepers, not occupants of the room and therefore not those described, is very small.

### Rooms and Brief Description of the Cases occupying each.

Room A: Occupied by two lepers, one a purely nerve case, the other showing general leprous infiltration over a large portion of the face.

Room B: Occupied by one leper. Large nodules about ears and a few small ones on face.

Room C: Occupied by one leper, showing numerous small papules and nodules scattered over face.

Room D: Occupied by one leper, showing diffuse infiltration of lobule of one ear and numerous small nodules scattered over the face.

Room E: Occupied by two lepers, both advanced cases, showing nodules and infiltration over a large part of their faces.

Room F: Occupied by two lepers, one showing small nodules scattered over face and some diffuse infiltration, the other case showing extensive leprous infiltration and nodules scattered over a large part of the face.

Room G: Occupied by one case, showing diffuse infiltration about malar regions and lobules of the ears.

Room H: Occupied by one case, showing infiltration of lobules of both ears; no other lesions on face.

Room I: Occupied by one case, showing nodules scattered over face, with inner one-third of face showing general infiltration.

The following table is self-explanatory; all the preparations and examinations were made by the method previously described. All the insects referred to in this table were blood-filled female specimens of *C. cubensis*. The smear was made from thirty minutes to three hours after the capture of the insect.

| Designation of room | No. of cases | Type of cases | No. of mosquitoes procured from this room and examined | Result of the examination of these insects |
|---|---|---|---|---|
| A .. | 1 | Nerve case .. | 108 | No acid-fast bacilli found. |
| | 1 | Tubercular .. | | |
| B .. | 1 | Do. .. | 68 | Do. |
| C .. | 1 | Do. .. | 71 | Do. |
| D .. | 1 | Do. .. | 100 | Do. |
| E .. | 2 | Do. .. | 17 | Do. |
| F .. | 2 | Do. .. | 95 | Do. |
| G .. | 1 | Do. .. | 2 | Do. |
| H .. | 1 | Do. .. | 14 | Do. |
| I .. | 1 | Do. .. | 18 | Do. |

| | |
|---|---|
| Tubercular cases exposed to mosquitoes .. .. | 11 |
| Blood-filled mosquitoes examined.. .. .. | 493 |
| Acid-fast bacilli found .. .. .. .. | 0 |

The failure to find bacilli in the insects may be supposed to be due to one or more of the following causes:—

(1) The cases were not suitable ones for the test.

(2) By chance the insect failed to bite over a nodule.

(3) The insect when at liberty purposely avoids nodules and chooses the areas of healthy skin.

(4) For some reason (as previously mentioned by Ehlers and Bourret) the mosquito does not take in bacilli when it feeds from the blood of leprous nodules.

(5) That the bacilli are soon destroyed in a mosquito's stomach.

As to the first of these reasons, the cases were all of the nodular type except one, and were average cases of the middle period of the disease; *i.e.*, most of them would neither be called "very early" nor "advanced" cases.

As to the second point, it is believed that the number of the insects examined excludes, on the face of it, such a supposition.

As to the third, it appears quite improbable, as we know nothing analogous to it in the mosquito's feeding habits; this point is to be investigated in our future work.

As to the fourth supposition, this appears to most easily explain our results, and is borne out by the observations of two previous investigators; this is also to be investigated.

As to the fifth, the single experiment was so strikingly positive that this supposition is considered most improbable, but will be repeated with lepra bacilli.

None of our cases were advanced enough to lead one to suspect that a bacillæmia existed. That such a condition does occur at times is fully testified to, but the relatively small number of bacilli present even in such cases is also shown by the persons that have sought for it in vain. These two facts, the rarity of leprous bacillæmia and the relatively small number of bacilli present per unit of blood, are sufficient to exclude, on mathematical grounds, such an occurrence as being of epidemiological importance.

### Conclusions.

Mosquitoes feeding, under natural conditions, upon cases of nodular leprosy so rarely, if ever, imbibe the lepra bacillus that we can exclude them as one of the ordinary means of transference of this bacillus from lepers to the skin of healthy persons. This insect is therefore not of epidemiological importance in this disease.

By a further series of experiments Dr. Currie found:—

(1) That if mosquitoes should imbibe any body fluid that contains lepra bacilli, they will not only take those bacilli into their digestive tracts, but will keep them there, morphologically unchanged, for several hours.

(2) That the mosquito, when it bites over a lepra-bacilli-filled nodule, does not imbibe the bacilli.

(3) That when given its choice, the insect appears to show no preference for either the normal skin or a nodule.

If the first and second of these three observations are correct, then it follows that the insect, when it punc-

tures the skin over a leprous nodule, draws only bacilli-free fluid, this alone accounting for the absence of bacilli in its body after such feeding. The investigator, in attempting to imitate the insect by puncture, invariably draws a bacilli-filled fluid. The fluid of a nodule that is rich in bacilli is the lymph. The only bacilli-free fluid that a nodule could contain is that within the vessel walls of the general circulation (capillary or small venule).

From this reasoning, based upon the data obtained in the experiments cited above, it is evident that, while it is impracticable for man to obtain lymph-free blood through a puncture of the skin, this insect is able to, and does, insert its proboscis directly into a capillary or other small vessel and draws pure blood directly from the general circulation.

In these experiments, as in those described in the first paper, we are dealing with cases of the afebrile stage of leprosy. Our experiments, therefore, present no data as to what may occur during the febrile stage of the disease, in which bacillæmia is present. But, as stated in the foregoing paper, the stage of bacillæmia is relatively rare, and the number of bacilli per unit of blood is relatively small; even though the mosquito does imbibe bacilli in such febrile cases, it must occur too seldom to be of great epidemiological importance.

(1) Dr. Currie therefore concludes that the reason that mosquitoes that have fed on lepers do not contain the lepra bacilli is that when these insects feed they insert their proboscis directly into a blood-vessel and thus obtain bacilli-free blood, unmixed with lymph.

(2) That the above-mentioned habit alone accounts for the absence of lepra bacilli in mosquitoes that have fed on lepers; the insect neither avoids biting a leprous nodule, nor is its digestive tract or the contained fluids capable of altering the morphology of this bacillus in a reasonable length of time.

The experiments done by Dr. Currie with flies are equally interesting to those performed with mosquitoes. Different species of flies found in Honolulu and Kalawao, were experimented on; for example, *Musca domestica*, *Sarcophaga pallinervis* (Thomson), *Sarcophaga barbata* (Thomson), *Volucella obesa* (Fabr.) and an undetermined species of *Lucilia*. The first-named fly was by far the most numerous. Dr. Currie believes that the work he has done on flies, taken together with the well-known habits of certain of these flies, establishes the truth of the following statements:—

(1) That given a bacilli-discharging leprous ulcer (and practically all leprous ulcers due to the breaking down of a leprous nodule do discharge bacilli), unprotected from the attacks of flies, these insects will convey the bacillus of leprosy to the skin of near-by healthy persons.

(2) That such insects will contaminate the foodstuffs of such persons with these organisms.

(3) That these insects deposit their fæces on every conceivable surface, and such fæces, becoming dry and pulverized, will in the form of "dust" convey the bacilli to the nasal mucosa of near-by persons.

That given such an unprotected ulcer, and the usual number of flies, this contamination of the skin and mucosa of near-by healthy persons will not be an unusual event, but will occur again and again, through an indefinite length of time, and the number of bacilli thus conveyed to healthy persons will be enormous.

This much the experiments show; but the below-mentioned points at once present themselves, and can not in our present state of knowledge be answered by laboratory data:—

(1) Is the skin (or abrasion of it), the mucosa of the digestive tract, or the nasal mucosa capable of being infected with leprosy?

(2) Are the bacilli that have been discharged from an ulcer and afterwards passed through a fly's digestive tract alive and capable of infecting man?

(3) Do epidemiological and clinical observations bear out the supposition that flies help to spread leprosy?

As to the first of these, we know that by some means lepra bacilli *do* gain entrance to the tissues of man. It is difficult to conceive how this is brought about, except that the bacilli penetrate one or more of the surfaces mentioned as being frequently contaminated, directly or indirectly, by the fæcal contents of flies.

As to the second, on this we have very little data. In the well-known case of Arning, the prisoner Keanu was inoculated with a leprous nodule that had not broken down into an ulcer. The patient developed leprosy, but he had been in contact with lepers in his own family and in prison (Swift). Furthermore, he was a Hawaiian. The mathematical probabilities of one of these people developing leprosy under ordinary conditions is (and was at the time of the experiment) high.

Bearing on this we also have the case of Coffin, in which a prisoner purposely inflicted a wound of the skin and inoculated himself with leprosy, employing in this case as material the pus of a leprous ulcer. The man developed leprosy, but he had, before inoculating himself, been exposed to lepers.

On the other hand, many alleged and authentic cases of human inoculation, performed usually by means of a wound of the skin, have failed to reproduce leprosy. In weighing this evidence, however, it must be remembered that much negative evidence is required to outweigh a very few positive results in a matter of this kind.

Bearing indirectly on this question, we know that in rat leprosy, a disease closely resembling human leprosy, the inoculation of an abrasion of the skin of a healthy rat with the bacilli contained in an ulcer of a leprous rat is usually followed by infection.

As to the third of these questions, Do epidemiological and clinical data bear out the supposition that flies help to spread leprosy? The writer, in connection with another work, has had occasion to review recently a large mass of data and opinions contained in the literature bearing on the general subject of transmission of leprosy. The most striking point that appears in much of the literature is the large number of lepers that give a history of personal contact of the most intimate character with a leper (for a long or short period) previous to developing the first symptoms of the disease. Examples could be cited that would seem to show that those persons who reside in

the same house with a leper, but do not eat or sleep with or administer to the patient, are much less often attacked than persons who, in addition to residing with the afflicted person, also come in very intimate contact with him.

This, of course, is against transmission by an insect having a considerable excursion of flight, like the fly. This observation is not strongly against household infection, for the probabilities of the fly carrying the infection to some one within the household are far greater than those of the insect carrying the infection to a near-by dwelling; but it is distinctly against fly-borne infection that a person sleeping in the next room should be quite exempt, while the person sleeping in the same room is apt to be infected. We do not admit such is the case, however, although the experience of many would appear to indicate this.

In considering the matter, it should be remembered that it is improbable that any *one* insect, mechanism, or means is alone responsible for the spread of leprosy; furthermore, that while observations of a clinical and epidemiological character should be given due weight, it must be remembered that data of that kind have often led to errors.

### Conclusions.

(1) That the above-named flies, when given an opportunity to feed upon leprous fluids, will contain the bacilli in their intestinal tracts and fæces for several days after such feeding.

(2) That the above fact, together with the well-known habits of these flies, makes it certain that, given an exposed leprous ulcer, these insects will frequently convey immense numbers of lepra bacilli, directly or indirectly, to the skins, nasal mucosa, and digestive tracts of healthy persons.

(3) That our present state of knowledge does not permit us to determine whether such insect-borne bacilli are or are not capable of infecting persons whose skin and mucosa are thus contaminated; but until we have more accurate knowledge on this point we are justified in regarding these insects with grave suspicion as being one of the means of disseminating leprous infection.

## Correspondence.

*To the Editor of the* Journal of Tropical Medicine and Hygiene

Sir,—With reference to the discussion on Chromosantonin which took place at the Society of Tropical Medicine and Hygiene, on March 17, I would crave permission to point out to those who are intending to try the treatment that it is essential that properly prepared chromosantonin should be used. The drug must be of a deep yellow to orange colour, not mixed with white, and the colour change should extend through the crystals; and as there are very few places in this country having a stock of this properly prepared drug, merely issuing a prescription is not sufficient. The practitioner should satisfy himself by *inspection* that it is being correctly supplied. And the warning is necessary because, to the writer's knowledge, slightly yellowed santonin has been supplied in substitution for the proper drug.

I am,

Yours faithfully,

*April* 18, 1911. J. Preston Maxwell.

### A RARE INJURY.

*To the Editor of the* Journal of Tropical Medicine and Hygiene.

Sir,—A lad who had been thrown from his bicycle during a race was brought to me a few days ago suffering from an injury to the left wrist. At first sight it appeared to be a Colles's fracture. On examination I was surprised to find a dislocation backwards of the hand at the radiocarpal joint, On slight traction it was very easily reduced.

The great rarity of this injury makes the case worth recording.

Yours &c.,

BEN GEO. BROCK, L.R.C.P., L.R.C.S., D.P.H.

Germiston, South Africa,

*February*, 1911.

## THE UNIVERSITY OF LIVERPOOL.

### Faculty of Medicine.

*Diploma in Tropical Medicine.*

The Diploma in Tropical Medicine has been awarded to the following:—

B. Blacklock, M.D.
C. C. Iles, M.B., Ch.B.
A. Ingram, M.D.
T. Kirkwood, M.B., C.M.
B. Knowles, M.B., Ch.B.
G. M. B. Liddle, M.B., B.Ch.
W. W. Mackarell, M.D.
R. R. Murray, M.B., Ch.B.
K. A. Rao, M.B., Ch.B.
J. A. Sinton, M.B., B.Ch., B.A.O.
B. S. Tarapurvalla, L.R.C.P. & S., L.F.P. & S.
W. M. Woods, L.R.C.P. & S., I.

## LONDON SCHOOL OF TROPICAL MEDICINE.

### Examination Result (Thirty-fifth Session, January to April, 1911).

*Alexander, J. B., M.B., Ch.B., D.P.H. (Colonial Service).
*Butler, G. G., M.R.C.S., L.R.C.P., M.B., B.C. (Colonial Service).
*Chell, G. R. H., M.R.C.S., L.R.C.P. (Colonial Service).
Crichton, A. J. M., M.B., Ch.B. (Colonial Service).
*Crossle, Captain, H., I.M.S., M.D.
*Hanschell, H. M., L.R.C.P., M.R.C.S.
*Hay, M. B., M.R.C.S., L.R.C.P., D.P.H. (Colonial Service).
Hunt, Major S., I.M.S., M.B., B.S.
Kennedy, A. F., M.B., B.Ch. (Colonial Service).
Martinez, J. Santamaria, M.D. (Colombia).
*O'Brien, A. J. R., M.B., Ch.B., D.P.H., B.Hy. (Colonial Service).
Scott, W. H., M.R.C.S., L.R.C.P.
*Shaw, Captain C. C., I.M.S., M.B., B.S.
Standish, F., M.B., B.S., L.R.C.P., M.R.C.S.
Witt, E. E., D.M. (Rostoch).
*Wilson, C. J., M.B., B.C., M.R.C.S., L.R.C.P.
Wyler, E. J., M.D., B.S., M.R.C.S., L.R.C.P.

* With distinction.

## Awards.

BOVRIL has been awarded the Diplôme d'Honneur (the highest award), at the International Cookery Exhibition, Paris.

DOWN BROS. LTD., of St. Thomas's Street, London, S.E., have followed up their recent successes at the Brussels and Buenos Aires Exhibitions (Grand Prix Brussels, 1910, and Gran Premio Buenos Aires, 1910), by securing the Gold Medal (highest award) for Surgical Instruments and Aseptic Hospital Furniture at the United Provinces Exhibition at Allahabad, 1910.

## Annotations.

*Blackwater Fever.*—Brem, in a paper read at the seventh annual meeting of the American Society of Tropical Medicine at St. Louis, June 11, 1910, and published in the *Archives of Internal Medicine* for February 1911, brings forward some new ideas on the etiology and treatment of blackwater fever. Briefly stated, he believes that blackwater fever is a term that includes two types of hæmoglobinuria, more or less definitely associated with malaria. It is important, he considers, that the two types be separated for study and treatment, as the indications for the treatment of the two are diametrically opposed. The two types probably differ in the mechanism of their production, and their clinical phenomena are different. In his first type the hæmoglobinuria, he believes, is associated with pernicious malaria infections. The hæmoglobinuria is probably brought about, according to him, by immediate destruction of erythrocytes by enormous numbers of sporulating parasites, and the time of its appearance can generally be foretold [*how can it?*] with a fair degree of accuracy. The treatment is that of pernicious malaria fever. In his second type the hæmoglobinuria is indefinitely associated with malaria, and probably brought about by the solution of erythrocytes by an unknown hæmolysin. He proposes that the names "blackwater fever," "malarial hæmoglobinuria," and "hæmoglobinuric fever" should be abandoned, and that the two types described by him should take their place as Type 1, pernicious malaria fever with hæmoglobinuria; and Type 2, erythrolytic hæmoglobinuria.

In his second type he states that the hæmoglobinuria was precipitated by quinine in a certain number of cases, in others it was only apparently precipitated; while in the remainder quinine could have had nothing to do with it. The presence of malaria parasites in the blood of patients suffering from erythrolytic hæmoglobinuria, Brem believes, has no effect on the mortality or on the clinical phenomena, and affords no indication for treatment during hæmoglobinuria. When parasites persist or reappear during convalescence, or when fever persists or recurs after the cessation of hæmoglobinuria, quinine should be given guardedly. The dose should be small at first and gradually increased, if hæmoglobinuria is not precipitated. One thing Brem's paper brings out clearly is that blackwater fever would seem to be much commoner on the Isthmus of Panama than has generally been supposed. Deaderick, in his recent book on malaria, has also drawn attention to the prevalence of this disease in the Southern States of America, so that its geographical range, once attention has been directed to it, is evidently becoming a much wider one.

*The Identification of the Typhoid and Dysentery Bacillus.*— In the *Australian Medical Gazette* for January 20, 1911 (No. 352, vol. xxx., No. 1), Burton Bradley writes on the identification of *Bacillus typhosus* (Eberth, Gaffky) and *B. dysenteriæ* (Flexner). The definite identification of both these organisms, he states, is often a matter of considerable importance, and also one of considerable difficulty, especially when fæces, urine, pus, shellfish, ice-cream, milk, water, sewage, &c., have to be examined, because in such substances the number of organisms with allied properties is very confusing. In addition nowadays so many pseudo-bacilli and different strains have been isolated that a differential diagnosis must necessarily include these as well, and such work to be of any value must be conducted in a proper bacteriological laboratory. Unfortunately, even when conducted in such a place, errors may creep in, though the number of these is necessarily reduced. The broad distinction between *B. typhosus* and *B. dysenteriæ* (Flexner) Bradley gives in a series of tables, the technique recommended for the isolation of *B. typhosus* being adopted also for the latter with a modification of step 4, as the *B. dysenteriæ* cultures give acid on mannitol, *nil* on sorbitol, *nil* on saccharose, and acidity followed by a neutral and then a slight alkaline reaction on litmus milk, which should be observed up to fifteen days if the acid reaction has diminished, but has not turned alkaline during the first week. The indol reaction is positive generally in four days, and gelatine is not liquefied.

Bradley states that he has isolated from the fæces of two cases, diagnosed as dysentery, and from one case of dysentery after parturition, organisms of the *Typhosus-Flexner* type, and he hopes to publish the the complete investigation of these cases shortly.

## Recent and Current Literature.

*A list of recent publications and articles bearing on tropical diseases is given below. To readers interested in any branch of tropical literature mentioned in these lists the Editors of the* JOURNAL OF TROPICAL MEDICINE AND HYGIENE *will be pleased, when possible, to send, on application, the medical journals in which the articles appear.*

### "Journal of the American Medical Association," April 8, 1911.

Malcolm Seymour, of Boston, calls attention to the prevalence of trichiniasis in Italians in America following the eating of raw ham or prosciutto. His conclusions are:

(1) Trichiniasis is more common than is generally supposed, being erroneously diagnosed as typhoid, muscular rheumatism, influenza, laryngitis, neuritis, nephritis, and many other diseases.

(2) The diagnosis is not difficult, if in every case of

generalized muscular pain a differential count of the leucocytes is made, and, if possible, a bit of muscle excised for examination.

(3) More rigid examination should be made at the ports of entry, of foreign meat products, especially those of pork.

(4) The eating of all raw animal foods—sausages, ham, smoked beef, and the like—should be condemned. Much can be accomplished by the physician who comes in contact with the Italians, in pointing out the dangers of eating underdone or raw pork foods.

### "Sleeping Sickness Bulletin," April 10, 1911.

The Sleeping Sickness Bulletin, issued April 10, 1911, contains the following papers. (1) The transmission of trypanosomes. (2) Sleeping sickness investigations in German East Africa. (3) The demonstration of trypanosomes by the cultural method. (4) Treatment of trypanosome infections. (5) Differentiation of trypanosome species. (6) Wassermann reaction in trypanosomiasis. (7) Trypanosomiasis of animals. (8) Prophylaxis of surra and other papers. (9) Sleeping sickness news. (10) Monthly list of references.

### "Report of the Department of Sanitation of the Isthmian Canal Commission," February, 1911.

Major Gorgas reports that for the month of February, 1911, the total number of deaths from all causes among employees working at the Isthmian Canal was 41. These were divided as follows: From disease 26 and from violence 15, giving the annual average per thousand at 6·27 and 3·61, respectively.

Among employees for February of previous years, the annual average death rate per thousand was as follows:

| | |
|---|---|
| 1905 ... ... ... ... ... | 14·05 |
| 1906 ... ... ... ... ... | 29·09 |
| 1907 ... ... ... ... ... | 30·74 |
| 1908 ... ... ... ... ... | 12·80 |
| 1909 ... ... ... ... ... | 9·42 |
| 1910 ... ... ... ... ... | 8·75 |
| 1911 ... ... ... ... ... | 9·88 |

The annual average death rate per thousand in the cities of Panama, Colon, and the Canal zone, including both employees and civil population, was 18·60.

The annual average per thousand for the month of February for previous years in the cities of Panama, Colon, and the Canal zone was as follows:

| | |
|---|---|
| 1905 ... ... ... ... ... | 42·07 |
| 1906 ... ... ... ... ... | 43·96 |
| 1907 ... ... ... ... ... | 36·07 |
| 1908 ... ... ... .. .. | 21·40 |
| 1909 ... ... ... ... ... | 18·59 |
| 1910 ... ... ... ... ... | 17·50 |
| 1911 ... ... ... ... ... | 18 60 |

In segregating according to race, the annual average death rate per thousand from disease among employees was, for whites 5·67, and for blacks 6·47, giving a general average for disease of 6·27. For the same month during 1909 the annual average death rate per thousand from disease among whites was 6·85 and blacks 6·97, giving a general average of 6·98; and in 1910 from disease among whites 5·20 and blacks 4.59, giving a general average of 4·73.

Among employees during the month, the deaths from the principal diseases were as follows: Chronic nephritis, 4; hæmoglobinuric fever, 1; organic diseases of the heart, 3; lobar pneumonia, 3; tuberculosis, 3; and dysentery, 2, leaving 10 deaths from all other diseases, and 15 deaths from external violence.

An epidemic of measles of a mild form has existed on the Isthmus for several weeks.

No cases of yellow fever, smallpox, or plague originated on or were brought to the Isthmus during the month.

## Personal Notes.

INDIA OFFICE.

*Arrivals Reported in London.*—Major J. L. Macrae, I.M.S., B.; Captain E. W. C. Bradfield, I.M.S.; Lieutenant-Colonel the Hon. C. Mactaggart, I.M.S., B.; Captain L. M. Holmes, I.M.S.; Captain H. A. Williams, D.S.O., I.M.S., B.; Colonel W. A. Quayle, I.M.S.; Captain W. E. Brierley, I.M.S; Captain A. N. Thomas, I.M.S.; Captain A. E. J. Lister, I.M.S.; Captain W. E. R. Williams, I.M.S.

*Extensions of Leave.*—Major G. Lamb, I.M.S., B., 6 m., M.C.; Lieutenant-Colonel J. T. Daly, I.M.S., 6 m.; Captain F. D. O. Fawcett, I.M.S., 6 m., M.C.; Captain N. S. Wells, B., 6 m., M.C.; Major F. L. Blenkinsop, I.M.S., 5 m., M.C.; Captain E. A. Roberts, I.M.S., 3 m., M.C.

LIST OF INDIAN MILITARY OFFICERS ON LEAVE.

*Showing the Name, Regiment, or Department, and the Period for which the Leave was granted.*

Bradfield, Captain E. W. C., I.M.S.
Brierley, Captain W. E., I.M.S.
Carter, Captain R. M., I.M.S., till July 26, 1912.
Graves, Major D. H., I.M.S.
Harris, Captain E. T., I.M.S., 8 m., from January 26, 1911.
Holmes, Captain L. M., I.M.S.
Leonard, Captain W. H., I.M.S., 1 y., from February 21, 1911.
Lister, Captain A. E. J., I.M.S.
Millar, Captain G. M., I.M.S., 18 m., from June 1, 1910.
Quayle, Colonel W.A., I.M.S.
Rodgers, Lieutenant-Colonel J. W., I.M.S., 4 m. 26 d., from February 8, 1911.
Tkomas, Captain A. N., I.M.S.
Williams, Captain W. E. R., I.M.S.
Young, Captain G. J., I.M.S., 12 m., from February 10, 1911.

LIST OF INDIAN CIVIL OFFICERS ON LEAVE (INCLUDING MILITARY OFFICERS UNDER CIVIL RULES).

*Showing the Name, Province, and Department, and the Period for, and Date from, which the Leave was granted.*

Macrae, Major J. L., I.M.S., India Foreign, 8 m., February 2, 1911.
Mactaggart, Lieutenant-Colonel the Hon. C., I.M.S., Insp.-Gen. of Prisons, N.P.
McCay, Major D., I.M.S., B., 15 m., July 1, 1910.

COLONIAL MEDICAL SERVICE.

*West African Medical Staff.*

*No deaths.*

*Resignation.*—T. F. Bayfield, M.D., C.M.McGill, L.R.C.S., L.R.C.P.Edin., Medical Officer, Gold Coast, resigns his appointment.

*Retirement.*—R. L. Roe, M.B., C.M.Edin., Medical Officer, Southern Nigeria, retires on pension.

*Transfer.*—G. J. Rutherford, M.R.C.S.Eng., L.R.C.P.Lond., Provincial Medical Officer for Ashanti, has been selected for appointment as Assistant Principal Civil Medical Officer of Ceylon.

*No promotions.*

*No new appointments.*

*Other Colonies and Protectorates.*

D. Drew, M.B., B.Ch., B.A.O.Dublin, L.M.Ireland; R. Drummond, M.R.C.S.Eng., L.R.C.P.Lond., and N. J. Watt, M.B., Ch.B.Edin., have been selected for appointment as Medical Officers in Nyasaland.

## Notices to Correspondents.

1.—Manuscripts sent in cannot be returned.

2.—As our contributors are for the most part resident abroad, proofs will not be submitted to those dwelling outside the United Kingdom, unless specially desired and arranged for.

3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.

4.—Authors desiring reprints of their communications to the JOURNAL OF TROPICAL MEDICINE AND HYGIENE should communicate with the Publishers.

**5.—Correspondents should look for replies under the heading "Answers to Correspondents."**

# Original Communications.

## CURATIVE INFLUENCE OF ROENTGEN RAYS IN MALARIA.

By H. D. McCulloch, M.B., M.S.(Glas.).

The original article under the above title, by Lieut.-Colonel Bruce Skinner, M.V.O., R.A.M.C., and Lieut. H. W. Carson, R.A.M.C., which appeared in the *British Medical Journal* of the 25th February last (p. 431), is one that not only opens up a new and important field in the early treatment of those essentially blood-infections, in which the spleen, the liver, and, to a lesser extent, the pancreas, is involved, but it also throws interesting light upon those infective processes the result of infections, which are not intravascular and *of the blood primarily*, in which the lymphatic glands, which are distributed in so many parts of the body, become involved. As examples of the former, we have septic endocarditis and malaria, and of the latter tuberculosis and syphilis.

In 1906 I made a contribution to the *Lancet*, entitled "Observations on the induction of auto-vaccination by X-ray irradiations of the lymphatic glands in tuberculosis, and other glandular infections, as revealed by the opsonic chart."

That work received corroboration at the hands of Drs. Lawrence and Crane, of the United States, in tuberculosis, and with Messrs. Paoli and Nuncioni, of Italy, in primary syphilis.

Now the physiological relationship of the spleen and the bone-marrow on the one hand, and that of the lymphatic glands on the other, have been well known in connection with the reactive processes which are termed inflammatory. There is deposited in these various glands masses of neoplastic cells, which increase the bulk of these glands, greatly hampering their physiological functions, particularly where the microbic invasion is sudden and extensive, as in the early stages of malarial fever, during the period of sporulation. The resulting conditions are variously termed splenitis, hepatitis and adenitis, &c.

In dealing with these conditions we are concerned with relieving distressing symptoms and the elimination of the cause, which, up to the present time, we have been able to achieve with more or less success. But of the resulting fibrositis and induration, this has been left to time and nature to deal with. The repression of fibrositis, or the regulation of these reactive processes, in the early stages, has not been possible, beyond what has been achieved by fomentations, poultices and packs, and a recourse in the later stages to arsenic and the iodides. The value of the time-honoured and judicious use of quinine, when administered by sub-cutaneous infection for preference as a malarial parasiticide, is not disputed; but in dealing with these conditions and their sequelæ, it will be admitted that much remains to be done that it has not hitherto been possible to do.

Medicinal fibrolytic, alterative and resolvent remedies have been tedious, irksome and disappointing in the majority of cases.

In the X-rays we now have a means of achieving these much to be desired ends, with absolute safety to the patient, and in a short time. No doubt, what occurs after recovery from these fevers is a crippling of portions of these glands, and a compensating hypertropy in those directions where the gland parenchyma has escaped the constricting effects of fibrositis, just as when one kidney is surgically removed its fellow undergoes functional hypertrophy to meet the needs of the body, this being a true hypertrophy and not a fibrositis.

In 1907-08 three cases of splenic and hepatic hypertrophy, the result of malaria in Englishmen, came under my treatment by the X-rays, and in one, who was able to meet the extra cost, a series of blood examinations were made previous to, during and after the treatment. This was a patient of my friend Mr. Neill MacGillycuddy, of Bournemouth, who sent him to me at my suggestion. His anæmia was his chief complaint, though there was marked enlargement of both spleen and liver. His colour index soon rose from a little above half the normal, to 88 per cent., and this improvement synchronized with a marked reduction in the size of his spleen and liver. The blood examinations were made for me by the Bournemouth Borough Bacteriologist, and by the Clinical Research Association. In all three cases the results were very gratifying.

I happened to visit London shortly after these experiences, and mentioned them to Mr. James Cantlie and Sir Patrick Manson. The former lent me his ear, and I was pleased to hear from him that his friend Dr. Ironside Bruce had also had similar success with enlarged spleens. I cannot recall whether he referred to leucocythemic spleens as much excellent X-ray work in this connexion had already been done. But they are two very divergent pathological states, that of leucocythæmia being more comparable to the status lymphaticus, while that of malaria is a pseudo-reactive hypertrophy, and one that is far more amenable to X-ray treatment.

The authors of the paper above referred to, unfortunately, neither enter into the X-ray technique adopted by them, nor do they seem to have made any blood examinations, but to me their remarkable experiences are very convincing, since my experience with the X-rays, which began in India with oriental sores in 1899.

The authors conclude their paper by stating that they also have five cases of chronic enlargement of the spleen after malaria, and that in these cases they are not able to speak yet with any certainty. Such, however, are the cases which I have dealt with, and they afforded the most gratifying results.

I regret I am unable to accept the suggestions of the authors, in regard to the essential therapeutics of the X-rays, which they compare with the effect of heat, with which there is not the remotest analogy. In the X-rays we have, what has been termed, a "fourth state of matter," a most potent molecular agency, which influences cells according to their individual molecular complexity and their relative instability. The more recently and rapidly developing cells are more influenced in regard to their resolution, these are those that have become "fixed" and more relatively stable. Spermatozoa, the lymphocyte and the neurone, are some of our most complex cells, but

micro-organisms, even of a pathogenic kind, are not so influenced, because of their lesser molecular complexity and relative stability.

It may be asked, how then do you account for the X-ray burn, or the X-ray cancer, so-called? It is well known that the rapid abstraction of heat by the application to the surface of a piece of $CO_2$ snow for a few minutes, instead of a few seconds, will also cause a burn or frost bite, which is followed by extensive necrosis, just as the injudicious use of too prolonged and unfiltered X-rays will cause similar changes, without any infinitesimal trace of heat reaching the skin.

## REMARKS ON SOME CULTURAL CHARACTERS OF THE FUNGI OF *TINEA IMBRICATA*.

By Dr. ALDO CASTELLANI, M.D.

*Director, Clinic for Tropical Diseases, Colombo.*

THE description I have given of *Endodermophyton concentricum* and *E. indicum* (JOURNAL OF TROPICAL MEDICINE AND HYGIENE of March 15, 1911) is based on the appearance of cultures kept in the dark, at the temperature of the room (80° to 90° F.), and using tubes closed in the usual manner with cotton wool plugs, *without rubber caps*. If any of these conditions is altered the cultural characters may be greatly changed. For instance, when rubber caps are used both *E. indicum* and *E. concentricum* take often a beautiful bright-red colour. If, however, subcultures are made from these, using tubes closed in the ordinary way with cotton wool plugs, without rubber caps, the fungi show again after a time the same appearances I have described in my papers. Various changes in the cultural character of the fungi take place, as it was to be expected, also when they are exposed for a long time to strong light, lower or higher temperature than usual, &c.

I may take this opportunity to state that further inoculation experiments have amply confirmed that the malady can be easily reproduced in human beings by inoculation of pure cultures of the fungi, as described in my previous publications.

REFERENCE.

JOURNAL OF TROPICAL MEDICINE AND HYGIENE, December 15, 1910, and March 15, 1911.

## THE PEKING INTERNATIONAL PLAGUE CONFERENCE. (REUTER.)

THE second week of the International Plague Conference has now drawn to a close, and it is probable that another week will see its deliberations almost concluded. Many extremely interesting topics in regard to the recent epidemic have been discussed. Perhaps one of the most important was the question of the infectivity of the breath in cases of pneumonic plague.

### INFECTIVITY OF THE BREATH.

Dr. Strong, the American Delegate, read a very interesting paper on this question. He recounted the results of a series of tests made by him in Mukden. Agar plates, previously sterilized, were exposed before plague patients at various distances for various periods, and under various conditions. Dr. Strong found plague bacilli on the plates in almost every instance in which the patient had coughed during the period of exposure, but his experiments demonstrated that breathing alone did not result in plague bacilli being scattered into the air. His conclusions may be summed up as follows. During normal and dyspnœic respiration of primary pneumonic cases, plague bacilli are not usually expelled by means of the expired air; during coughing in such cases, even when sputum visible to the naked eye is not expelled, plague bacilli in large numbers may become widely disseminated into the air surrounding the patient. He expressed the opinion that infection might be carried for a distance of several yards by coughing, that it might also be disseminated by forcible talking, and that doctors and nurses in attendance on cases of plague pneumonia should protect themselves with overalls, masks, and glasses, and sterilize their clothing immediately after leaving the wards.

### INFECTIVITY OF CORPSES.

Professor Zabolotny, of St. Petersburg, spoke upon the question of the infectivity of corpses. In corpses, exhumed three months after death, during the recent epidemic, he had found living plague bacilli, a fact of far-reaching importance in connection with the possibility of a recrudescence of plague in Manchuria, through the medium of marmots and other rodents.

### PROPHYLACTIC INOCULATION.

The most controversial subjects so far discussed are prophylactic inoculation, and serum therapy, and up to the present no definite conclusions have been arrived at upon either. In regard to the first, Dr. Strong stated that his conclusions were that vaccination in plague with a properly attenuated culture, is as harmless in human beings as vaccination against small-pox; during the present epidemic, prophylactic inoculations by dead cultures have been very frequently shown to be ineffective, some individuals inoculated three times in this manner having succumbed to plague; the conference should thoroughly investigate the question of true vaccination against plague; a suitable culture for such vaccination should be recognized internationally as a standard culture, and placed with some well-known bacteriological institute from which it can be obtained at all times; vaccination with such standard culture should alone be countenanced.

Professor Galeotti, the well-known Italian scientist, considered vaccination with living cultures too dangerous, and advocated the use of the bacteria nucleo proteid, prepared by Professor Lustig and himself, as a safer and equally efficacious prophylactic.

### SERUM THERAPY.

Serum therapy provoked even more discussion. In the course of it, cases were mentioned in which plague-pneumonia patients had been given as much as 800 and even 1,000 c.c. of anti-pest serum, without any effect other than prolonging life for a day or two. The results of investigations of this subject are most disappointing. By experiments with animals, Dr.

Martini, one of Koch's assistants, has shown that unless serum treatment in large doses is given immediately after infection, it is unlikely to prove effective in cases of plague-pneumonia. He had found in the case of rats that serum to the amount of about $\frac{1}{60}$th of the animal's weight was necessary to ensure protection, and that even then the protective effects only lasted about five days.

### Sub-committee Appointed.

A sub-committee has been elected to sift the evidence in regard to the various prophylactic and serum treatments advocated by different schools, and it is hoped that before the Conference disperses some definite recommendations will be made. It is worth recording that the Japanese claim to have cured five cases of pneumonic plague at Dairen (Dalny) with a serum prepared in Tokio, but the tests by which they confirmed the diagnosis of plague are not generally regarded as sufficiently exhaustive.

### Pathological Anatomy.

The following are the conclusions of a most exhaustive and comprehensive paper on the above subject, prepared by Drs. Strong and Teague, based upon the result of twenty-five autopsies conducted by them.

Epidemic plague-pneumonia results from inhalation, the primary point of infection being the bronchi. Through the bronchi the plague bacilli reach the lung tissue, and rapidly multiplying there, produce at first pneumonic changes of the lobular type, and shortly afterwards more general lobar involvement of the lung tissue. The blood becomes quickly infected, and a true bacteriæmia results in every case. Secondary pathological changes occur, particularly in the spleen, bronchial glands, heart, blood-vessels, kidneys and liver. The fact, that the bronchial glands at the bifurcation of the trachea are always much more severely affected than any of the other lymphatics, argues against the theory that epidemic pneumonic plague is primarily a septicæmic disease, and that the lungs are affected secondarily from the blood. Moreover, in the earliest stage of the disease, the blood may be free from plague bacilli. The condition observed in the trachea and bronchi in epidemic pneumonic plague is pathognomic of this condition alone. From the appearance of the mucous membranes of the throat and larynx a diagnosis of pneumonic plague may sometimes be made. The tonsils become secondarily infected in pneumonic plague, just as other lymph glands—for example, the bronchial ones—become so infected. However, in pneumonic plague, death occurs before any very marked microscopic changes occur in the tonsils. There is no doubt also that the tonsils may become primarily infected in epidemics of pneumonic plague, just as has occurred in sporadic cases during epidemics of bubonic plague. This, however, is not the common mode of primary infection, and in such cases involvement of the lymphatic glands of the neck occurs early in the course of the disease. The fact that the œsophagus was found to be normal in every case examined, constitutes another argument against the idea of primary intestinal plague infection, since in many of these pneumonic cases plague bacilli must have been repeatedly swallowed in the bronchial secretions and saliva.

In the discussion upon this paper Dr. Wang, of Mukden, referred to the cases of one donkey and nine mules which had died with all the symptoms of pneumonic plague, and had infected men who had been in contact with them. Dr. Martini explained how, by the passage of a strain of bubonic bacilli through the lungs of several rats in succession, the virulence of the strain was so much increased that after four or five passages rats died in thirty instead of seventy-two hours. This, he thought, proved that passage from lung to lung during the recent epidemic accounted for the virulence of the strains of bacilli isolated in Manchuria.

### Clinical Observations.

Clinical data was the next subject upon the programme. Various speakers referred to the character of the plague encountered in the recent epidemic, but no definite evidence was given in regard to the so-called abdominal type, of which a few cases are said to have occurred. A curious feature of plague pneumonia, confirmed by several observers, is the frequent absence of marked physical signs in the chest, even in advanced stages of the disease. Though the tarabagan, a species of marmot, has been generally regarded as responsible for starting the recent epidemic, Dr. Gray, of Peking, pointed out that there was no evidence of any marked outbreak of tarabagan disease during the past winter, and suggested that the epidemic might have been started by a small local outbreak—of which there have been many examples—near the Manchurian frontier, and that the tarabagan hunters gathered in the neighbourhood were particularly susceptible to the disease owing to the hardships and scanty nourishment they put up with during the hunting season.

### Decline Spontaneous.

Evidence given by several delegates pointed to a spontaneous decline of pneumonic plague, quite apart from the precautions adopted to combat the epidemic, the disease having disappeared about the same time in cities where every possible measure was taken to stamp out the infection, and in smaller towns and villages where no modern sanitary measures were employed. A very interesting description was given by Dr. Christie, of Mukden, of a woman, who though she never contracted the disease herself was the means of infecting eleven other persons in the course of fourteen days. So far as can be ascertained this is the only case in which infection was carried by a person who was not suffering from plague.

In contrast to the scientific side of the discussions was an informal account, given by Dr. Aspland, of Peking, of the methods adopted by a Chinese doctor of the old school in treating plague. This doctor claimed that he had cured himself of the disease, and though he attended upwards of a hundred cases without effecting a single cure, and without adopting any of the precautions observed by doctors of the modern school, he escaped unscathed. The main portion of

his treatment was "slapping," either with the sole of a shoe or a hempen cord. This drastic remedy, he claimed, drove the disease out of the system.

### The Tarabagan.

Twelve tarabagans (marmots) were brought down from Harbin during the past week, and they were at once taken in hand by Dr. Petrie, of the British Delegation, who chloroformed them all in turn to search for fleas. An average of four of these insects was found upon each animal. The tarabagan flea is believed to be a new species, as no one has reported their discovery hitherto. If it can be proved that they will bite human beings an important link in the chain connecting the marmot with the Manchurian epidemic will have been forged. Consequently, the single flea so far captured alive is being jealously preserved until it is hungry enough to test whether it will make a meal off man.

Mukden, Manchuria,
*April* 15, 1911.

(*Further Report on p.* 158.)

**"The Journal of the American Medical Association." April 8, 1911.**

Strosnider writes on the prevalence, harmful results and treatment of hook-worm disease in North Carolina. The result of his investigations shows that the disease is common there. The following statistics are those collected by Dr. J. A. Ferrell, director of the North Carolina campaign.

| | Examined, No. | Infected, Per cent. |
|---|---|---|
| First Regiment North Carolina soldiers | 372 | 36 |
| Second Regiment North Carolina soldiers | 366 | 58 |
| Third Regiment North Carolina soldiers | 149 | 32 |
| Coast Artillery North Carolina soldiers | 218 | 30 |
| N.C.A. and M. College (coloured) | 93 | 16 |
| Presbyterian Orphanage, Barium Springs, N.C. | 165 | 40 |

Odd Fellows' Orphanage, Goldsboro, N.C. :—

| | Examined, No. | Infected, No. | Infected, Per cent. |
|---|---|---|---|
| Total | 96 | 52 | 54 |
| Girls | 51 | 27 | 53 |
| Boys | 45 | 25 | 55 |
| Counties represented | 27 | 21 | 77 |

Methodist Orphanage, Raleigh, N.C. :—

| | Examined, No. | Infected, No. | Infected, Per cent. |
|---|---|---|---|
| Boys | 48 | 36 | 75 |
| Girls | 83 | 44 | 53 |
| Total | 131 | 80 | 61 |

Masonic Orphanage (coloured), Oxford, N.C. :—

| | Examined, No. | Infected, No. | Infected, Per cent. | Ascaris Present. |
|---|---|---|---|---|
| Boys | 50 | 6 | 12 | 39 |
| Girls | 58 | 7 | 12 | 38 |
| Total | 108 | 13 | 12 | 77 |

For the toxic symptoms which may appear after the administration of thymol, Strosnider recommends that cardiac stimulants should be given, morphin and atropin, strychnine, digitalin or ergot, subcutaneously, and hot coffee per rectum. Alcoholic stimulation should be avoided. The patient should be kept recumbent. Hot blankets should be applied to the body and a warm water enema used.


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THE JOURNAL OF

# Tropical Medicine and Hygiene

May 15, 1911.


## BERI-BERI AND UNCURED RICE.

Since Dr. Braddon first put forward his suggestion that beri-beri was associated with the consumption of uncured or polished rice much work has been accumulated in favour of this view. His conclusions, first put forward in a paper, read at a Congress in 1901, were received by many with considerable doubt, especially so as the Dutch had previously put forward a somewhat similar hypothesis, but Braddon nevertheless returned to the subject and eventually published a book entitled "The Cause and Prevention of Beri-beri," which appeared in 1907. This work, as he says himself in the preface, consisted chiefly of a report presented to the Colonial Office in May, 1904, to whom he offers his grateful acknowledgment for their official permission to him to publish and use the material contained in that report. The book attracted a considerable amount of attention at the time of its publication and Sir Patrick Manson, recognizing the cogency of many of the arguments, got the Government of the Straits Settlements to arrange an experiment specially designed to test the truth or otherwise of the theory. Manifestly if there was anything in the idea people fed on cured or unpolished rice would be safe and would not acquire the disease.

Drs. Fraser and Stanton were associated with Dr. Braddon in this experiment and it is right to say that most of the carefully worked out details were the work of Dr. Stanton. The result was very distinctly in favour of Dr. Braddon's views and a similar line of procedure was then adopted for several of the Government Institutions throughout the Malay Peninsula. Dr. Gilbert Ellis reported success from the use of "cured" rice in one of these and then it was seen that there was decidedly something in the theory. Since that date Drs. Fraser and Stanton have done very useful work on the question, their reports having been noted in the Journal from time to time. In another part of the

Journal of to-day's issue will be seen an annotation from the Journal of the American Medical Association in which Victor G. Heiser of Manila describes what has been done as regards the use of unpolished rice in the Philippines.

There it will be seen that in May, 1910, an executive order was issued by the Governor-General of the Philippine Islands prohibiting the use of polished rice in all public civil institutions. Since August, 1910, only two cases of beri-beri have come to Dr. Heiser's notice from the above places, and this must speak for itself. To get everyone to use unpolished or cured rice does not appear to be as easy as it seems, however, merchants and others interested often being opposed to the change on commercial and monetary grounds. To obviate such a difficulty, therefore, a bill has been drafted in the Philippines which has for its purpose the bringing about of the general use of unpolished rice in those places where rice is the staple article of diet. After considerable discussion amongst physicians, lawyers, legislators, and others it was deemed advisable to attempt this with a law that would impose a tax of 5 centavos (2½ cents, U.S. currency) per kilo on all polished rice sold, whether foreign or domestic. It will be interesting to see how this will work. One would have thought that employers of labour, once they realized that beri-beri could be avoided by using a certain form of rice, would have insisted on having this form alone, and by so doing would gradually have weakened the market for the dangerous or toxic kind. The people generally will have to be educated, and the Governments of the various countries interested will have to see how this can be done, helping at the same time materially themselves by insisting on only unpolished or cured rice being used in all institutions and other places under their immediate control.

There seems to be a splendid chance open, as Dr. Heiser puts it, of eradicating one of the world's most serious and costly diseases, and with so many confirmations as to the value of the method now before the world it must seem strange if it is not immediately acted upon.

What, perhaps, is the most interesting thing about this new idea is, of course, that it is not really new, but is a revival of a past theory which somehow or other fell out of favour. Fortunately, however, it has come to the front again, and one must sincerely hope that it will now stay there.

[Dr. Braddon's letter on beri-beri which also appears in to-day's issue only came to hand after the above was written. THE JOURNAL OF TROPICAL MEDICINE AND HYGIENE has always recognized the part Dr. Braddon has played in the discovery of uncured rice as the cause of beri-beri, but at the same time, due praise must also be given to those who, like Drs. Fraser and Stanton, have gone on with the work and amplified it. We regret the tone in which Dr. Braddon has seen fit to approach this matter as shown in the letter we publish elsewhere in this number.—ED.]

## Abstract.

### A PRELIMINARY ACCOUNT OF SOME EXPERIMENTS UNDERTAKEN TO TEST THE EFFICACY OF THE IPECACUANHA TREATMENT OF DYSENTERY.[1]

By Captain EDWARD B. VEDDER.
*Medical Corps, U.S. Army.*

(*From the United States Army Board for the Study of Tropical Diseases as they exist in the Philippine Islands.*)

THIS is a very important paper by Captain Vedder, of the Medical Corps of the United States Army. The author used for his experiments two varieties of amœbæ, one isolated from tap water, the other isolated from the stool of an ordinary man. He has not been able to positively identify either of these, but it is certain that neither were the *Entamœba coli*, or *E. dysenteriæ*. The author readily admits that the results would have been more conclusive if the latter parasite had been used, but he does not think that this fact influences the importance of his results; certainly not until the time when the amœbæ of dysentery have been cultivated and found by actual experiment to be non-susceptible to the toxic action of ipecacuanha. Until proved to be untrue he thinks it is fair to assume by analogy that a drug like ipecacuanha which is harmful to the amœbæ found in water and in the normal human intestine is likely to be similarly harmful to the amœbæ causing dysentery.

After preliminary remarks on the divergence of opinion as to the value of the ipecacuanha treatment in dysentery the writer passes on to a description of his experiments. These were undertaken, he states, with a view of determining, first, whether ipecacuanha has any decided action against either the bacilli of dysentery or such amœbæ as can be cultivated; second, if such action be present, to determine how ipecacuanha compares with other remedies that have been used in the past, such as quinine and silver nitrate; and third, to determine to what constituents of the ipecacuanha this action is due.

For the purpose of determining the effect of ipecacuanha upon the *Bacillus dysenteriæ* two series of experiments were made. (1) Agar slants were used, the agar having been previously thoroughly mixed with fluid extract of ipecacuanha in such a proportion that each tube contained 2 per cent. of ipecacuanha—the growth of the bacilli on this medium were then compared with their growth on identical agar tubes minus the ipecacuanha and also on the same kind of agar mixed with fluid extract of hydrastis, tincture of digitalis and tincture of opium in 2 per cent. strength. Other organisms such as *B. typhosus*, *B. para-typhosus* and *Staphylococcus pyogenes aureus* were also grown on the ipecacuanha agar.

The result of one of these experiments described is follows:—

[1] A paper read before the Manila Medical Society on February 6, 1911, by permission of the Chief Surgeon, Philippines Division.

| No. | Medium | Result |
|---|---|---|
| 1 | Control, plain agar + *B. dysenteriæ* (Shiga) | Good growth |
| 2 | 2 per cent. ipecacuanha agar + *B. dysenteriæ* (Shiga) | Markedly less growth |
| 3 | Control, plain agar + *B. dysenteriæ* (Flexner) | Good growth |
| 4 | 2 per cent. ipecacuanha agar + *B. dysenteriæ* (Flexner) | Markedly less growth |
| 5 | Control, plain agar + Morgan No. 1 bacillus | Good growth |
| 6 | 2 per cent. ipecacuanha agar + Morgan No. 1 bacillus | Less growth |
| 7 | Control, plain agar + *Staph. aureus* | Good growth |
| 8 | 2 per cent. ipecacuanha agar + *Staph. aureus* | Same as control |
| 9 | Control, plain agar + *B. paratyphosus* | Good growth |
| 10 | 2 per cent. ipecacuanha agar + *B. paratyphosus* | Only a trace of growth |
| 11 | Control, plain agar + *B. typhosus* | Good growth |
| 12 | 2 per cent. ipecacuanha agar + *B. typhosus* | Only a trace of growth |
| 13 | 2 per cent. digitalis agar + *B. dysenteriæ* (Shiga) | No growth |
| 14 | 2 per cent. digitalis agar + *B. dysenteriæ* (Flexner) | Markedly less growth than control |
| 15 | 2 per cent. digitalis agar + Morgan No. 1 bacillus | No growth |
| 16 | 2 per cent. hydrastis agar + *B. dysenteriæ* (Shiga) | No growth |
| 17 | 2 per cent. hydrastis agar + *B. dysenteriæ* (Flexner) | Slight growth, less than control |
| 18 | 2 per cent. hydrastis agar + Morgan No. 1 bacillus | Slight growth, less than control |
| 19 | 2 per cent. opium agar + *B. dysenteriæ* (Shiga) | Slight growth. Less than control but about the same as on ipecacuanha agar |
| 20 | 2 per cent. opium agar + *B. dysenteriæ* (Flexner) | |
| 21 | 2 per cent. opium agar + Morgan No. 1 bacillus | |

In the second series ordinary bouillon was used with fluid extract of ipecac., fluid extract of hydrastis, tincture of digitalis and tincture of opium added in a strength of 2 per cent. to certain tubes. These tubes with control tubes of the same bouillon were inoculated with a single loopful of a twenty-four-hour bouillon culture of the various organisms used, and, after incubation for twenty-four to forty-eight hours, plates were made from each tube, using the same number of loopfuls from each tube in inoculating the agar for the plate. The plates were then incubated for twenty-four hours and the colonies counted.

The result of one of these experiments is as follows:—(See table.)

These experiments were repeated several times with substantially the same results and Vedder therefore concludes:—

(1) That 2 per cent. fluid extract of ipecacuanha inhibits the growth of dysentery bacilli.

(2) That this is not a specific action, since ipecacuanha also inhibits the growth of other bacteria, while other drugs such as hydrastis and digitalis are quite as powerful as the former in inhibiting dysentery bacilli.

(3) That the *B. dysenteriæ* of the Shiga type that he worked with appears to be more susceptible to the action of ipecacuanha and other drugs than the Flexner strain.

| No. | Medium | Number of colonies on plate |
|---|---|---|
| 1 | Control, plain bouillon + *B. dysenteriæ* (Shiga) | Innumerable |
| 2 | 2 per cent. ipecacuanha bouillon + *B. dysenteriæ* (Shiga) | 0 |
| 3 | Control, plain bouillon + *B. dysenteriæ* (Flexner) | Innumerable |
| 4 | 2 per cent. ipecacuanha bouillon + *B. dysenteriæ* (Flexner) | 0 |
| 5 | Control, plain bouillon + Morgan No. 1 bacillus | Innumerable |
| 6 | 2 per cent. ipecacuanha bouillon + Morgan No. 1 bacillus | 0 |
| 7 | Control, plain bouillon + *Staph. aureus* | Innumerable |
| 8 | 2 per cent. ipecacuanha bouillon + *Staph. aureus* | 1 |
| 9 | Control, plain bouillon + *B. typhosus* .. | Innumerable |
| 10 | 2 per cent. ipecacuanha bouillon + *B. typhosus* | 0 |
| 11 | Control, plain bouillon + *B. paratyphosus* | Innumerable |
| 12 | 2 per cent. ipecacuanha bouillon + *B. paratyphosus* | 3 |
| 13 | 2 per cent. digitalis bouillon + *B. dysenteriæ* (Shiga) | 0 |
| 14 | 2 per cent. digitalis bouillon + *B. dysenteriæ* (Flexner) | Innumerable |
| 15 | 2 per cent. digitalis bouillon + Morgan No. 1 bacillus | 0 |
| 16 | 2 per cent. hydrastis bouillon + *B. dysenteriæ* (Shiga) | 0 |
| 17 | 2 per cent. hydrastis bouillon + *B. dysenteriæ* (Flexner) | 1 |
| 18 | 2 per cent. hydrastis bouillon + Morgan No 1 bacillus | 0 |
| 19 | 2 per cent. opium bouillon + *B. dysenteriæ* (Shiga) | 0 |
| 20 | 2 per cent. opium bouillon + *B. dysenteriæ* (Flexner) | Innumerable |
| 21 | 2 per cent. opium bouillon + Morgan No. 1 bacillus | Innumerable |

(4) That the treatment of bacillary dysentery by ipecacuanha is not recommended because it has not been shown that this drug possesses any greater activity against dysentery bacilli than many other drugs, and because it would probably be difficult, on account of dilution with intestinal contents, to give sufficient of it to make a solution in the intestine as strong as a 2 per cent. solution of the fluid extract which was the strength used in these experiments. However, since it has been shown to inhibit the growth of dysentery bacilli to some extent, it has probably done patients with bacillary dysentery no harm, and on the other hand, may possibly have accomplished some good, particularly if the dysentery was caused by the Shiga type of *B. dysenteriæ*.

As regards the action of ipecacuanha on the amœbæ Vedder found that this was much more powerful. Amœbæ in a five per cent. bouillon culture were at once killed by a fluid extract of ipecacuanha in a dilution of 1-50,000 and sometimes were even killed in higher dilutions such as 1-200,000. The same experiments were subsequently repeated using a different fluid extract of ipecacuanha, and it was found that this ipecacuanha did not kill amœbæ in dilutions above 1-10,000.

An analysis of this sample was made and it was found to contain 0·885 grams of total alkaloids per 100 c.c. while the U.S. Pharmacopœia requires 1·75 grams per 100 c.c.; this preparation of ipecacuanha therefore was less than half as strong as it should have been. Preparations of ipecacuanha were then obtained and the total amount of alkaloids contained in each were determined by Mr. J. Rosario, of the Bureau of Science, through the courtesy of the officials of the Bureau of Health. Using these preparations of known strength the experiments were continued in the following way.

To distilled water sufficient bouillon was added to make a five per cent. solution. Several sterile test tubes were filled with this five per cent. bouillon for controls, while other tubes were filled with various dilutions of the different fluid extracts of ipecacuanha or other drugs to be tested, using the five per cent. bouillon as the diluting fluid. It was next ascertained that the amœbæ used in these experiments grow freely in five per cent. bouillon. All the tubes were inoculated with a single loopful of a stock culture of amœbæ, always taking care to demonstrate that a single loopful of this culture contained numbers of living amœbæ. These tubes were allowed to stand at room temperature for three days, making a microscopic examination of each tube every day. These observations always showed that amœbæ were present in enormous numbers in the control tubes of plain bouillon, while varying degrees of inhibition were found in the tubes containing ipecacuanha depending upon the variety of the drug used and its dilution. In these experiments two varieties of amœbæ were used; one isolated from tap water, and one isolated from the stool of a normal man.

The bouillon used in all cases was five per cent. bouillon in distilled water.

It was evident that the fact that no amœbæ were seen in a drop or two from the negatives tubes was not proof that all the amœbæ were killed, although it could be accepted that their growth must have been inhibited. In order to determine whether the amœbæ were all killed, the entire contents of the tubes showing no growth were poured into sterile flasks containing bouillon mixed with distilled sterile water. These flasks were kept for several weeks and when no culture was obtained from them it was proof that the amœbæ in the negative tubes were really killed by the solution in the tube, since a culture may be readily obtained in a similar manner from one of the positive tubes.

From these experiments the author concludes:

(1) That ipecacuanha is a powerful amœbacide, since the weakest preparation used (with the exception of the de-emetized) killed in a dilution of 1-10,000.

(2) That different preparations of ipecacuanha on the market vary greatly in their ingredients and in the power of killing amœbæ.

(3) That emetin is a powerful amœbacide, killing amœbæ in dilutions of 1-100,000, which is double the dilution that was amœbacidal when fluid extract of ipecacuanha was used.

The author believes it probable that the power of any given specimen of ipecacuanha to kill amœbæ is directly dependent upon the proportion of emetin contained in it, though he cannot prove this at present owing to the fact that there is another alkaloid, cephælin, in ipecacuanha, but it seems probable that the latter substance may be lacking in amœbacidal properties for the following reasons. If cephælin were at all active, it would be possible to judge the amœbacidal properties of a preparation by estimating the total alkaloidal content. This, however, does not appear to be the case, since the ipecacuanha No. 2, with a total alkaloid content of 0·885, appeared to be fully as powerful as ipecacuanha No. 1 containing 1·8 total alkaloids. It was also noted as a clinical fact that the ipecacuanha root from Brazil gave the best results in the treatment of dysentery, and Paul and Cownley have found that Rio and Carthagena ipecacuanhas do not differ materially in total alkaloids, but that in the Brazilian root emetin is the dominant alkaloid, while in the Columbian root cephælin predominates, and that the roots are not therapeutically identical. Since it has been shown that emetin is an exceedingly active amœbacide, it is probable that this large emetin content is the reason for the greater excellence of the Brazil root, and that cephælin is comparatively inert. There is no proof that the action of the ipecacuanha is due to other less active components such as resins, gums or ipecacuanhic acid, since these elements were present in the ipecacuanha *sine* emetin (No. 3) tested which was almost inert; and the action must have been more or less specific to

INFLUENCE OF IPECACUANHA AND EMETIN ON GROWTH OF AMŒBÆ.

| No. | Medium | Drug used | Total alkaloid in drug; per cent. | Total strength of drug in medium | Observations for presence of amœbæ after | | |
|---|---|---|---|---|---|---|---|
| | | | | | 24 hrs. | 48 hrs. | 72 hrs. |
| 1 | Bouillon control ... ... ... | ... ... ... ... ... ... | ... | — | + | + | + |
| 2 | Bouillon + Ipecacuanha ... ... | Ipecacuanha No. 1 ... ... ... | 1·80 | 1- 10,000 | — | — | — |
| 3 | Bouillon + Ipecacuanha ... ... | Ipecacuanha No. 1 ... ... ... | 1·80 | 1- 20,000 | + | + | + |
| 4 | Bouillon control ... ... .. | ... ... ... ... ... ... | ... | — | + | + | + |
| 5 | Bouillon + Ipecacuanha ... ... | Ipecacuanha No. 2 ... ... ... | 0·885 | 1- 10,000 | — | — | — |
| 6 | Bouillon + Ipecacuanha ... .. | Ipecacuanha No. 2 ... ... ... | 0·885 | 1- 20,000 | + | + | + |
| 7 | Bouillon control ... ... ... | ... ... ... ... ... ... | — | — | + | + | + |
| 8 | Bouillon + Ipecacuanha ... ... | Ipecacuanha No. 3 .. ... ... | 0·292 | 1- 5,000 | + | + | + |
| 9 | Bouillon + Ipecacuanha ... ... | Ipecacuanha No. 4 ... ... ... | 1·60 | 1- 20,000 | — | — | — |
| 10 | Bouillon + Ipecacuanha ... ... | Ipecacuanha No. 5 ... ... ... | Unknown | 1- 50,000 | — | — | — |
| 11 | Bouillon + Emetin ... ... ... | Emetin ... ... .. ... ... | — | 1-100,000 | — | — | — |
| 12 | Bouillon + Opium ... ... ... | Tincture of Opium .. ... ... | — | 1- 2,000 | + | + | + |
| 13 | Bouillon + Hydrastis ... ... ... | Fl. Ext. Hydrastis ... ... ... | — | 1- 2,000 | + | + | + |

ipecacuanha, since the fluid extracts of such drugs as opium, ergot and hydrastis failed altogether to kill amœbæ in dilutions of 1-2,000.

A few experiments similar to the one described were performed with quinine sulphate and silver nitrate, and it was found that quinine in a dilution of 1-20,000 killed amœbæ but failed in higher dilutions, while silver nitrate was the most powerful of any drug tried, since it killed amœbæ in dilutions of 1-300,000. But although, as the author says, ipecacuanha is not so powerful an amœbacide as silver nitrate it may possibly give better results in actual treatment because in irrigations silver nitrate loses most of its strength, since it unites with the albuminous matters and salt in the fæces and tissues, leaving very little to attack the amœbæ high up in the colon, and because of the proverbial difficulty in reaching all portions of the colon with an irrigation. On the other hand, a large bolus of ipecacuanha given by the mouth goes into solution slowly, since it is sparingly soluble in water, and its action may be continuous throughout the entire intestinal tract, and it probably succeeds in reaching all parts of the colon.

Again, Vedder believes that while it may be difficult for the ipecacuanha in the intestine to act directly upon amœbæ that have burrowed deeply into the tissues, the emetin may act on these organisms after it has been absorbed into the blood stream. That this is so seems to be true, because both Wood and Hare state that the vomiting resulting from the administration of ipecacuanha is at least partially produced by action upon the vomiting centres in the brain. They also state that ipecacuanha is partially eliminated by the gastro-intestinal tract.

It is therefore quite possible that the emetin in solution in the body fluids may be capable of killing or inhibiting amœbæ deep in the tissues, especially during the elimination of the drug through the intestinal mucosa, which would cause it to come in intimate contact with amœbæ in the deep ulcers characteristic of amœbic dysentery. While in solution in the blood, it may even be capable of killing amœbæ in the liver, which would explain the good results reported by Rogers in the treatment of hepatitis and early liver abscesses caused by amœbæ.

Recently Duncan reported a case of balantidium dysentery treated by ipecacuanha, with prompt recovery; and, therefore, Vedder tried the action of ipecacuanha upon a species of paramœcium, and also a balantidium isolated from tap water, and both of these forms were killed by one of the preparations of ipecacuanha (No. 5) in a dilution of 1-50,000, and by emetin in dilution of 1-100,000; and, therefore, he rightly suggests the advisability of giving ipecacuanha a further trial in this form of dysentery as well.

In conclusion, Vedder states that his belief is that the ipecacuanha treatment of dysentery caused by protozoa should not on light grounds be set aside in favour of any other, but that in using this treatment great care should be taken to make sure that the dysentery is truly caused by protozoa, and is not bacillary, and also to obtain an ipecacuanha that is shown by actual analysis to contain its proper amount of emetin, and when this is not possible to insist upon obtaining the Brazil root.

# Helminthology.

## (b) Summary of Current Helminthological Literature.

### A NEW TREMATODE WITH A BLIND LAURER'S CANAL.

(Goldberger, 1911, iv., *Proceedings United States National Museum*, p. 233, vol. xl.)

GOLDBERGER has found a new species of the genus *Styphlodora*, to which he gives the name *S. bascaniensis*, the parasite having been obtained from the liver of a Bascanion constrictor in Virginia, U.S.A. The author places the new form close to *S. solitaria*, Looss, from which it differs most notably in that Laurer's canal, instead of opening on the dorsal surface of the body, terminates in a large globular blind sac about the size of the ovary. This sac contains spermatozoa, sperm morulas, round, deeply-staining bodies suggesting nuclei and a few vitelline cells. The only trematode having a similar condition is *Aspidogaster conchicola*. This new observation throws considerable light on the function of Laurer's canal. Hitherto two hypotheses have been held. The commonly accepted one, which maintains that the canal is a copulatory canal, the presence of sperm cells in it being adduced as evidence in its support; the other view, enunciated by Looss, that the canal acts as a sort of overflow to conduct away superfluous yolk substance that might clog the uterine tube. The presence of sperm cells and other cellular products in species in which Laurer's canal is imperforate seems to support the latter hypothesis strongly.

### TWO NEW FAMILIES OF DIGENETIC TREMATODES IN FISHES.

(Odhner, 1911, iii, *Zoologischer Anzeiger*, March 21, vol. xxxvii.)

ODHNER groups the following genera and species of digenetic trematodes found in the rectum of marine fishes into a new family *Zoogonidæ*: (1) *Lepidophyllum*, Odhner, 1902 (*L. steenstrupi*, Odhner); (2) *Diphterostomum*, Stossich, 1904 (*D. brusinæ*, Stoss., *D. betencourti*, Montic.); (3) *Zoogonoides*, Odhner, 1902 (*Z. viviparus*, Olss., *Z. subæquiporus*, n. sp.); (4) *Zoogonus*, Looss, 1901 (*Z. mirus*, Looss, *Z. rubellus*, Olss.); and a new genus *Proctophantastes* for a new species *P. abyssorum* in the rectum of *Macrurus rupestris* and *Gadus æglefinus*.

A second family, also from fishes, is created under the name *Monorchidæ* for the sub-families: (*a*) *Monorchinæ*, containing the genera (1) *Monorcheides*, Odhner, 1905 (*M. diplorchis*, Odhner); (2) *Monorchis*, Looss, 1902 (*M. monorchis*, Stoss., and *M. parvus*, Looss); and (*b*) *Proctotreminæ*, containing the genera (1) *Proctotrema*, n. g. (*P. bacilliovatum*); (2) *Lasiotocus*, Looss, MSS. (*L. mulli*);

(3) *Pristisomum*, Looss, MSS. (*P. pumex*, n. sp., and *P. caducum*, n. sp.); (4) *Asymphylodora*, Looss, 1899.

## *PARAGONIMUS WESTERMANI* IN WISCONSIN, U.S.A.

(H. Hanson, 1911, iv, *Bulletin Johns Hopkins Hospital*, p. 112, vol. xxii.)

Up to the present time only three specific cases are on record of the occurrence of lung flukes in the United States. After the return of the troops from the Philippines some anxiety existed lest an introduction of lung distomiasis might follow. The disease has, however, only appeared in the domesticated animals hitherto, if we exclude a doubtful imported case from Portland, Oregon. Ward has recorded the fluke from the lung of a cat in Michigan and in a dog at Ohio. A third record implicates the hogs slaughtered in Cincinnati, Ohio. The paper here annotated describes the infection of a cat and her two kittens born in the village of Wauwatosa, Wisconsin. There is not the least doubt in this case that the infection was acquired in the locality.

## THE FAMILY *MONOSTOMIDÆ* A POLYPHYLETIC GROUP.

(Odhner, 1911, iii, "Zum naturlichen System der digenen Trematoden I," *Zoologischer Anzeiger*.)

For some years Odhner has been of opinion that the *monostomes* cannot be considered a natural family, but as composed partly, or possibly entirely, of *Distomes*, in which the ventral sucker has become lost by reduction. A study of the monostome family *Angiodictyidæ* has led him to the conclusion that this family at least belongs to the group *Amphistomidæ* and that the posterior sucker has been lost.

## SHEEP ROT (*FASCIOLA HEPATICA*) IN MAN.

(Ward, 1911, iv, *Brit. Med. Journ.*, April 22, p. 931.)

G. R. Ward gives an interesting account of a case of heavy infection with *Fasciola hepatica* in a man admitted to Tunbridge Wells General Hospital, Kent. On admission there was an eosinophilia of 37.2 per cent., the hæmoglobin 70 per cent., number of red blood corpuscles normal. There were considerable numbers of ova in the fæces—four or five in each microscopical preparation.

# Correspondence.

## BERI-BERI.

*To the Editor of the* Journal of Tropical Medicine and Hygiene.

Sir,—If science be the exact expression of facts accurately ascertained, then the leader which appeared in your columns on "Tropical Research," in your issue of March 15 last, in its reference to research done on beri-beri, deviates so far from the scientific normal that perhaps you will not resent my criticising a passage in it which, as a statement, is inaccurate, and (what I feel you would care for more) in its implication is unjust.

You refer to *Drs. Fraser and Stanton* as having "done excellent work as regards the part that rice plays in the spread of beri-beri." What have they done?

It will be news to you, and to many of your readers no doubt, to learn that Drs. Fraser and Stanton have, so far, contributed not a single new or original independent observation of *any* facts determining whether it be the origin or "the spread" of beri-beri.

It is true that after I had published evidence establishing the position of beri-beri as a disease due not to infection (as commonly believed), but the result, merely, of eating a certain sort of rice, and when I had obtained from the local Government an opportunity to demonstrate, by crucial experiment, the truth of that view, Drs. Fraser and Stanton were associated with me, by the Government, in the experiment, in order to report on the results obtained. That experiment—the Durian Tipus Inquiry—was (as it had been hoped it might be), completely successful.

It demonstrated once more, under conditions of control, what I had already proved by evidence far more extensive, that in the production of beri-beri (at least as it happens here), the one and only essential causal factor is the consumption of uncured rice.

Being successful, Drs. Fraser and Stanton reported on the experiment in that sense to Government—but they presented the results to the public as entirely their own!

Nowhere in the text of the two publications which they made of the results, nor in numerous public repetitions of them afterwards, did they refer to the present writer by whom, both officially and in fact, the observations actually, in part at least, were made, as having either initiated or contributed to the result!!

It is true that Drs. Fraser and Stanton have done some excellent work on the chemical differences which exist between rice which does, and rice which does not, produce beri-beri; and in confirmation of Eijkman's well-known observations on the production of polyneuritis from rice in hens.

But as regards the practical, the epidemiological aspects of the beri-beri question, they have added nothing new or original to the issue.

When you say, therefore, in your Editorial "it is no exaggeration to say that the following up of Dr. Braddon's original *idea* by these two men may in time save thousands and thousands of lives," &c., the suggestion that my part was merely to have furnished an idea, a surmise, which these two men had the greater merit of translating from regions of pure theory into facts of practical application, is an implication which does great (although I am sure unintentional) injustice to myself, and also to others.

For, in the first place, that beri-beri arose in some way from rice eating was never claimed by me to be my own original idea. Van Dieren and others are in print to the contrary.

But I did claim, and still do claim, that I first brought forward evidence which appeared irrefragable, and has indeed never been contested, which *proved* that theory beyond all possible doubt.

Moreover, *the remedy*, the simple, inexpensive, but wholly efficient *remedy*, by which beri-beri may be everywhere

completely prevented, was first indicated by me. That remedy is merely the substitution, wherever rice forms the staple of diet, of cured for the uncured sort of grain.

The remedy was recommended to, and it was adopted by the local Government of the Straits Settlements and the Federated Malay States in all their public institutions before ever Drs. Fraser or Stanton appeared upon the scene. Its success was such that beri-beri, long the scourge of jails and and the asylums, which it formerly had converted into death-traps and shambles, disappeared from them—instantaneously and completely, and for the first time in their history—merely on this substitution of cured for uncured rice.

In the hospitals, too, among cases already admitted for beri-beri, the death-rate formerly in many cases reaching such appalling figures as 30, 40, and even 45 per cent., was reduced by the same simple means to rates of no more than 10 per cent. or even 5 per cent.!

Your hope that "thousands and thousands of lives may in time be saved" is not exaggerated—they have already been saved—are annually being saved by the discovery—which is not, however, the work of Drs. Fraser and Stanton.

I am, Sir,
your obedient servant,
W. LEMAN BRADDON.

Mount Beryl,
Seremban, F.M.S.
*April* 17, 1911.

## Reviews.

TROPICAL MEDICINE AND HYGIENE, Part II ("Diseases due to Metazoa"). By C. W. Daniels, with a chapter on Snakes by A. Alcock. John Bale, Sons and Danielsson, Ltd. 1910. 7s. 6d. net.

In this, as in the previous volume, the author has provided a concise description of the tropical diseases due to animal parasites; the metazoan parasites are here briefly characterized and their life-histories detailed in so far as is necessary to explain the manner in which they are spread and the *rationale* of the preventive measures advocated. The diseases are grouped according to the parasites which cause them. This, as the author recognizes, has, at the present time, some disadvantages in that certain diseases with similar symptoms are widely separated, but, on the other hand, much is gained by the frank recognition that, say, dysenteric symptoms may result from totally distinct infections, necessitating different treatment and varied prognoses. The definite adoption of the laboratory method of diagnosis and the zoological mode of classification of disease by one who has had an unrivalled experience of clinical and pathological work throughout the Tropics is a striking testimony to the settled position attained by medical zoology as the handmaiden of tropical medicine.

The author is careful to point out that the text-book is in no sense a systematic treatise on medical zoology, and it is perhaps a matter for regret that out of 248 pages no less than 50 pages are occupied by a dissertation on snakes, although this is in itself admirable, and from the facile pen of Col. Alcock.

The book will be much appreciated by those wishing a first introduction to tropical medicine, in which facts and general principles are authoritatively given, unobscured by mass of detail. Prophylaxis, treatment and nursing are dealt with in a full and masterly manner. The volume is beautifully printed and well illustrated, although most of the blocks are taken from other works. One notes with regret that several are copied without acknowledgment. A few of the illustrations are somewhat misleading. The old picture of *Fasciolopsis rathouisi*, showing the testes side by side, is reproduced, although Odhner has shown from an examination of the original material that this is an error. Braun's figure of *Opisthorchis conjunctum* (Cobbold) is made to serve as *O. felineus* without explanation. Braun's block of *Metorchis truncatus* is reproduced, although there is no evidence that this species occurs in man. Space is given to a description of the genus *Syngamus*, although it does not occur in man or illustrate anything bearing upon tropical medicine. Systematic classification is a subject upon which it is perhaps well at the present time to let "each gang his ain gait," but one can scarcely forbear from remarking upon the confusion that must necessarily arise in the student's mind from the inclusion of the genus *Physaloptera* in the family *Strongylidæ*, and of *Oxyuris* in *Ascaridæ*.

For a work of reference the pathologist in the Tropics must look elsewhere, but as an introductory text-book the student will find here little lacking either in intent or execution.

RECENT ADVANCES IN HÆMATOLOGY. By Walter K. Hunter, M.D., D.Sc,, Lecturer in Medicine Glasgow University, being the Dr. James Watson Lectures for 1910. Henry Kempton, 13, Furnival Street, Holborn, London, E.C., with a coloured plate. 1911, pp. 119.

In clear and concise language Dr. Hunter gives an account of the blood in health and disease. He has wisely avoided bacteriological subjects, and given us an admirable account of the blood changes associated with disturbances of the corpuscles. Beginning with a review of the clinical examination of the blood as a whole, the author passes on to the departures from the normal, and to the appearances presented in such ailments as pernicious anæmia, paroxysmal hæmoglobinuria, splenomegalic polycythæmia, leukæmia, purpura, hæmophilia, and many more of the blood diseases.

A copious and excellent appendix deals with the fixing and staining of films. These lectures are pleasant to read and convey a wealth of information in a style which is readily followed and applied.

FREEMAN'S Chlorodyne is much employed in tropical countries where malaria, cholera, dysentery, colic, agues, and other miasmatic diseases prevail, with apparently beneficial results.

## Annotations.

*Plague in China.*—In the *Lancet* of April 29, 1911, page 1152, Douglas Gray, Physician to the Legation at Pekin, contributes a full and very interesting report on "The Septicæmic and Pneumonic Plague Outbreak in Manchuria and North China" (Autumn, 1910; Spring, 1911). All interested in the subject should read the report for themselves, but for those who are unable to do so, Dr. Gray's summary may be of value. He concludes, after a careful review of the circumstances, that: "(1) The first outbreak in Manchuria was among men who handled the tarabagan—an animal susceptible to epizoötic plague. (2) Beginning at a definite focus, plague was spread through the three provinces, by these men returning home. (3) Infection was kept up mainly by these coolies travelling in parties and sleeping together in inns under circumstances of constant intimate contact, with plague-stricken cases in their midst. (4) The extreme cold of Manchuria induced an indoor existence. Infection, by breath and personal contact of clothes and belongings, was thus made easy. (5) There is little evidence of infection having been contracted in the open air, otherwise than among groups of coolies. (6) The mortalities have been mainly among groups of south-bound coolies. (7) The next classes affected were the adult males, who stayed in infected inns travelling or mixing with the returning coolies. (8) When introduced into a house, infection often wiped out the whole family. (9) In towns which became thoroughly infected (as at Fuchiatien) by the passing crowds of coolies, the incidence of the disease persisted, and those residents who were affected were nearly all of the poorer classes. (10) That fairly close contact is necessary for conveyance of infection has been exemplified by the comparative immunity enjoyed by Russians living in the midst of the infected railway area at Harbin. The case of every Russian who died was traced to close contact with Chinese of the plague-affected class. (11) The rate of spread was parallel with the rate of travel, as shown by the early infection of places along the railway and those in close communication with it (*e.g.*, Hu-lan-fu and Harbin) as compared with the later infection of such populous towns as Petuna and Kirin. (12) Towns that had adopted preventive measures before they became badly infected—such as Tientsin, Tongshan, and Peking—practically escaped. (13) Isolation of patients and their contacts, and disinfection, when efficiently carried out, have invariably been followed by diminution of the death-rate. (14) Among rats examined at Harbin by Dr. P. Haffkine and in "20,000" rats examined by the Japanese plague staff no instance of plague infection was found."

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*Malarial Fever in Ismailia.*—In the *Journal of the Royal Army Medical Corps* for April, 1911 (No. 4, vol. xvi.), Sir David Bruce reports on the present condition of Ismailia, as regards malarial fever. His summary of what he found, and his remarks at the end of his paper, will commend themselves to all interested in the study of the prophylaxis of malaria. The essential points concerning the abolition of malaria in Ismailia are put in a nutshell. A quotation of Sir David Bruce's own words will show this:—

"One fact, however, impressed itself. The Suez Canal Company is all-powerful at Ismailia. The inhabitants, with the exception of a few natives and minor Government officials, are employees of the Company and are paid by it. Therefore, any regulations made by the Directors can readily be enforced. The disabilities of the capitulations under which the remainder of Egypt suffers do not affect Ismailia. There is absolute authority. Then the Company is a rich one; it has the necessary funds. With these two factors almost any sanitary reform may be carried out. And with them malaria has been exterminated at Ismailia. Nature has assisted these factors by supplying a rainless climate. The town being isolated in the desert has been easier to free from mosquitoes than many others would be, for surrounding irrigation and cultivation would have rendered the task a greater one. One can well understand tropical rains making malaria prevention a more expensive matter, for the drainage would then have to be more extensive, and the work of the mosquito brigade much increased. However, the fact remains that the work done at Ismailia has been thorough and malaria has been abolished."

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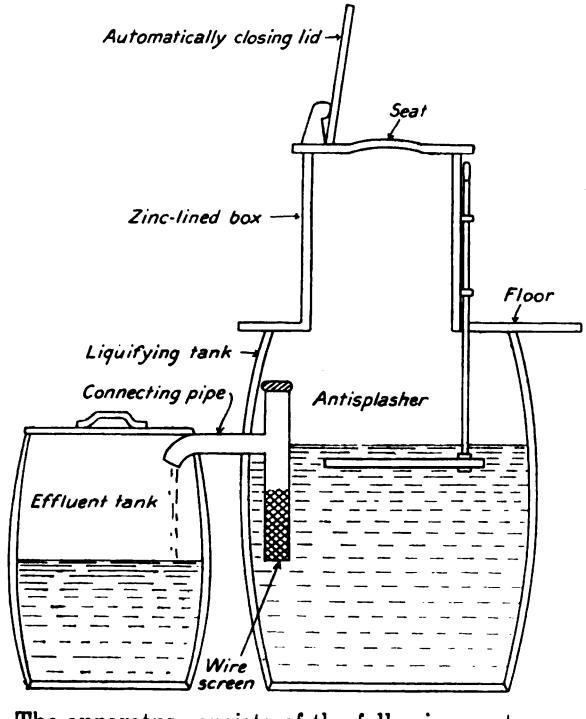
*Enzootic Plague in the United States.*—An editorial in the *Medical Record* of New York, February 11, 1911, deals with the important question of the prevalence of enzootic plague in the United States. Plague, this contemporary states, first manifested itself on a large scale in the United States in 1900, when an outbreak occurred in San Francisco in the Chinese quarter, and it was not until 1904, after having killed 225 people, that it was eradicated. Again, in 1907, further cases were met with amongst rats and men in San Francisco, and it was then thought that infected fleas might have been introduced with ground squirrels, which were constantly being brought into the city for food. In the following year some squirrels were definitely found to be infected with plague; and during the year after that (1909) systematic examinations proved that about one-seventh of the total area of California was infected, wood rats as well as squirrels suffering from the disease. Further observations showed that squirrel fleas will transmit plague to rats and rat fleas plague to squirrels, so that even though the latter do not come into towns yet they might infect country rats, which might in turn spread the disease to the town ones, and so start an epidemic which ultimately would reach man. That this is no theoretical danger the cases in San Francisco in 1907 would seem to show, and as long as the enzootic goes on amongst the small mammals of the country, there must necessarily exist a potential danger to man. A good omen is that the people of the country have shown a willingness to co-operate with the Public Health and Marine Hospital Service in the extermination of rats and squirrels, and as the latter

do an immense damage to crops, their destruction will meet both ends. As to the difficulty of the task all are aware, but as the writer of the editorial says, " If active and persistent steps are not taken to destroy the hosts, or at least keep them well under control, the disease may at any time break out in most destructive form."

*A Simple and Inexpensive Privy.*—Lumsden, in the United States Public Health Reports, vol. xxv., No. 45, makes a preliminary note on a simple and inexpensive apparatus for use in safe disposal of night soil. The apparatus has been in use in one of the workrooms of the Hygienic Laboratory for six months. The details of construction are presented at this time in order to place them at the disposal of any persons who may desire to experiment. Starting out on the principle that the forces of nature in fermentation should be utilized, and that economy and simplicity should be borne in mind, an effort has been made to reduce to a minimum the labour and skill involved in taking care of this privy. While sanitary safety has been the chief object in mind, the widespread demand that human excreta be turned to economic account has not been ignored.




The apparatus consists of the following parts:—

(1) A water-tight barrel to be used as a liquefier.

(2) A covered water-tight barrel, can, or other container to receive the effluent.

(3) A connecting pipe about 2½ in. in diameter, about 12 in. long, and provided with an open " T " at one end, both openings of the " T " being covered by wire screens.

(4) A tight box, preferably zinc-lined, which fits tightly on the top of the liquefying barrel; it is provided with an opening on top for the seat, which has an automatically closing lid.

(5) An anti-splashing device, consisting of a small board placed horizontally under the seat and 1 in. below the level of the transverse connecting pipe; it is held in place by a rod, which passes through eyes or rings fastened in the box, and by which the board is raised and lowered. The liquefying tank is filled with water up to the point when it begins to trickle into the effluent tank.

As an insect repellant a thin film of some form of petroleum may be poured on the surface of the liquid in each barrel.

When the privy is to be used, the rod is pulled up so that the anti-splashing board rises up to within 1 in. below the surface of the water. The fæcal matter falls into the water, but this board prevents splashing, and thus meets one of the greatest objections thus far raised to the wet system. Fly-breeding and feeding are prevented by the lid, the water, and the film of oil, This oil also prevents mosquitoes breeding. The fæcal matter becomes fermented in the water and gradually liquefies; the addition of excreta naturally raises the level of the liquid, and the excess flows into the effluent tank, where it is protected from insects by the cover and by the film of oil. This device solves the fly and mosquito problem so far as the privy is concerned. It liquefies fæcal matter and reduces its volume so that it may be safely disposed of more easily and cheaply than night soil. It reduces the odour, and reduces the labour of cleaning the privy. It is simple and of inexpensive construction.

The effluent can be disposed of by boiling, or burial, or by chemical disinfection previous to burial, when necessary. Toilet paper seems to be digested by the process. It is estimated that the amount of sludge from the dejecta of a family of five people would not be sufficient to require the cleaning of the liquefying tank oftener than once in six months to a year.

*The Etiology of Dysentery.*—Craig, in the *Archives of Internal Medicine*, March 15, 1911, writes on the *Entamœba tetragena* as a cause of dysentery in the Philippine Islands. Viereck described this amœba in 1907 in dysenteric cases contracted in South Africa and gave it the above name, while Hartmann and Prowazek met with the same organism about the same time. Craig now thinks that certain atypical forms of *E. coli* or *E. histolytica*, which he noted in soldiers suffering from dysentery in the Philippine Islands when he was there, must have been this *E. tetragena;* and consequently, if this view is correct, the geographical range of this new amœba is considerably widened. He further considers that the idea of some observers that the distinction between *E. coli* and *E. histolytica* is not based on sufficient evidence, is due to the fact that they have confused this *E. tetragena* with the species described by Schaudinn—a mistake which he (Craig) believes to be natural when one remembers that *E. tetragena* resembles both the species mentioned. This may be so, of course, but on the other hand, it may not; and more work is evidently required to settle this and other points concerning the intestinal amœbæ of man and the part they play in the production of dysentery.

*Intestinal Parasites of Man.*—Rosenberger contributes an interesting paper on "The Presence of Intestinal Parasites in Inmates of the Philadelphia General Hospital," to the *New York Medical Journal* for March 25, 1911. The diagnoses were made from the examinations of fæces in the ordinary manner. A total of 1,280 specimens was examined, 552 of these being fluid, 413 semi-fluid, while 315 were well-formed or solid stools. The results of the examinations were as follows :—

Of the fluid stools 92 contained ova or parasites.

| | |
|---|---|
| Cercomonas alone | 60 |
| Cercomonas with *Lamblia intestinalis* | 4 |
| *L. intestinalis* alone | 3 |
| *Entamœba histolytica, C. intestinalis,* and *L. intestinalis* | 1 |
| *E. histolytica* alone | 3 |
| *Tricocephalus dispar* alone | 10 |
| *T. dispar* and *Necator americanus* | 1 |
| *T. dispar, Strongyloides intestinalis,* and *Schistosoma hæmatobium* | 1 |
| Amœba and *C. intestinalis* | 3 |
| *N. americanus* | 1 |
| Strongyloides alone | 1 |
| Trichomonas | 2 |
| *Ascaris lumbricoides* | 1 |
| *Tænia saginata* | 1 |

Of the semi-fluid stools 53 contained ova or parasites.

| | |
|---|---|
| Cercomonas and *T. dispar* | 2 |
| Cercomonas alone | 30 |
| *T. dispar* alone | 2 |
| *T. dispar* and *T. saginata* | 1 |
| *T. dispar* and *A. lumbricoides* | 7 |
| *T. dispar* and uncinaria | 1 |
| *A. lumbricoides* alone | 3 |
| *E. histolytica* | 1 |
| *N. americanus* | 1 |
| Strongyloides alone | 2 |
| *Trichomonas intestinalis* | 1 |
| *T. dispar,* anchylostoma, and *A. lumbricoides* | 1 |
| *T. dispar, N. americanus, S. intestinalis,* and *A. lumbricoides* | 1 |

Of the solid stools 25 contained ova or parasites.

| | |
|---|---|
| Cercomonas alone | 18 |
| *N. Americanus* | 2 |
| *T. dispar* alone | 2 |
| *T. dispar* and *A. lumbricoides* | 1 |
| *Oxyuris vermicularis* alone | 3 |
| Uncinaria, *Strongyloides intestinalis,* and *A. lumbricoides* | 1 |

Total of infestations 179 :

| | |
|---|---|
| Cercomonas and amœba | 3 |
| Cercomonas alone | cases 108 |
| Cercomonas with lamblia | 4 |
| *T. dispar* alone | 14 |
| *T. dispar* and *A. lumbricoides* | 7 |
| *T. dispar* and ankylostoma | 2 |
| *T. dispar,* ankylostoma, and ascaris | 2 |
| *A. lumbricoides* alone | 4 |
| *L. intestinalis* | 3 |
| *Trichomonas intestinalis* | 3 |
| *N. americanus* | 4 |
| *E. histolytica* alone | 4 |
| *O. vermicularis* | 3 |
| *T. saginata* alone | 1 |
| *T. saginata* and *T. dispar* | 1 |
| *S. intestinalis* | 3 |
| *E. histolyitica, C. intestinalis,* and *L. intestinalis* | 1 |
| *T. dispar, S. intestinalis,* and *S. hæmatobium* | 1 |
| *T. dispar,* ankylostoma, *S. intestinalis,* and *A. lumbricoides* | 1 |
| Single infestations | 147 |
| Double infestations | 19 |
| Triple infestations | 3 |
| Quadruple infestations | 1 |

*Beri-beri and Rice.*—In the *Journal of the American Medical Association,* April 29, 1911, Victor G. Heiser, Director of Health and Chief Quarantine Officer for the Philippine Islands, gives his experiences with beri-beri and the use of unpolished rice in the Philippines. In February, 1910, the use of unpolished rice was made compulsory for all inmates of the Culion Leper Colony. After this month no deaths from beri-beri occurred. To quote Dr. Heiser's own words :—

"At the end of January, 1910, there were approximately fifty patients with beri-beri undergoing treatment in the Culion Hospital. On the suggestion of Dr. Aron, 15 grm. of rice polishings mixed with milk and sugar were given to these patients twice daily. Two patients in very advanced stages of the disease died within a few days after this treatment was begun ; all the others began to improve. Within two weeks half of the number were able to leave the hospital, and within four weeks every patient with beri-beri was reported as cured by the attending physicians of the hospital. So much for Culion.

"Prior to May, 1910, beri-beri was very common throughout the Philippines—in jails, lighthouse stations, charitable institutions, on Government vessels, and among the Filipino troops of the United States Army. An investigation has shown that it was the invariable practice to use polished rice as the staple article of diet in all of the places mentioned. In May, 1910, an executive order was issued by the Governor-General of the Philippine Islands prohibiting the use of polished rice in all public civil institutions. Since August, 1910, only two cases of beri-beri in the above places have come to my attention. One of these was among the crew of the steamer "Rizal." An inspection of the ship's stores showed that the crew's rice was of the white polished variety. Further inquiry elicited the fact that it was customary for most of the crew of this vessel to use a varied diet, which may account for the fact that there were not more cases. The other case occurred in a prisoner in the Tacloban gaol. The physician in charge reported that it had not been possible to purchase unpolished rice at Tacloban and for that reason polished rice was being used. He added, however, that every effort was being made to comply with the spirit of the executive order by using more meat, mangoes, potatoes, green vegetables and fish.

"At the Hospicio San José, which is an insane hospital, orphan asylum and asylum for the aged, of over 700 inmates, beri-beri had been constantly present, at least during the past ten years. Since June, 1910, unpolished rice has been used and a few weeks afterward beri-beri disappeared, and since then no further cases have been reported."

Dr. Heiser believes that this successful experience with unpolished rice, supporting as it does in every detail the original idea of Braddon and the work of Fraser, Stanton, Aron, Kilbourne de Haan and Highet, should be used by the medical profession of the East generally as a lever to get the various Governments to prohibit, as far as possible, the use of polished rice.

THE *Wassermann Reaction in Trypanosomiasis*: Bagshawe in the bulletin of the Sleeping Sickness Bureau for April, 1911, gives extracts of the recent work done on the Wassermann reaction in trypanosomiasis. A complete summary of the paper by Browning and McKenzie in the *Journal of Pathology and Bacteriology*, October, 1910 (pp. 182-191) is given, their conclusions being as follows :—

"(1) Little is known as to the conditions which cause rabbit's sera to react positively in the Wassermann test. Apparently normal rabbits may react positively. On the other hand, trypanosome infection in rabbits does not determine a positive reaction with the same certainty that syphilitic infection in the human subject does. Even when a non-sterilizing dose of arsenophenylglycin was administered, so that the infection had a protracted course, the sera did not invariably come to react positively. When the serum of an infected animal did give a positive Wassermann reaction the administration of non-sterilizing doses of arsenophenylglycin did not lead to disappearance, or even to a definite diminution, of the Wassermann reaction, although the tests were carried out at a time when the signs of disease had receded and the infection was obviously latent. These facts, together with the spontaneous variations in the behaviour of the sera of animals which have practically certainly been cured, indicate that no safe conclusions as to the action of pathogenic protozoa, or the effect of treatment on infections with these, can be based on the Wassermann reaction in the case of rabbits, a conclusion which agrees with that of Schilling and Hoesslin (1908) and Manteufel (1909). . . .

"(2) Positively reacting sera from rabbits infected with nagana trypanosomes deviated complement equally well with a variety of alcoholic extracts. A watery extract of the liver of a rabbit dead from the trypanosome infection was markedly inferior to the alcoholic extracts in this respect.

"(3) The sera of trypanosome-infected rabbits which after heating give a marked positive Wassermann reaction, in the fresh state may merely delay the progress of lysis of the test corpuscles, the reaction ultimately becoming negative. Fresh normal rabbit's serum did not prevent the occurrence of the Wassermann phenomenon with a syphilitic serum.

"(4) The high efficiency of *arsenophenylglycin* as a therapeutic agent in trypanosome infections was shown by the fact that two out of five rabbits infected with nagana trypanosomes were cured at a very advanced stage of the disease by a single intravenous injection of 0·035 to 0 04 grm. per kilo. of body weight, *i.e.*, about a sixth of the minimum lethal dose."

As regards human trypanosomiasis Bagshawe quotes A. de Azevedo Gomes as having obtained a positive result in Wassermann's reaction in twelve out of fifteen sleeping sickness patients. In thirteen trypanosomes were present both in the cerebro-spinal fluid and blood, in two in the blood only. In a second series of experiments in which a different technique was employed, the quantity of serum being less and that of amboceptor greater, four of the above cases when retested were negative.

*The Specific Treatment of Leprosy.*—Whitmore and Clegg contribute an article on the specific treatment of leprosy in the *Philippine Journal of Science* (vol. v., No. 6) for December, 1910. Their experiences were not favourable with any of the substances tried, Nastin being included amongst this number.

The conclusions arrived at were as follows :—

"(1) They prepared a vaccine, a glycerine extract and a soap solution, from an acid-fast bacillus which Clegg cultivated from leprous tissue. They used these preparations in the treatment of cases of leprosy for twelve and a half months, without noting any improvement in the condition of any of the patients. In some of the cases reactions after the injections took place, but they are not prepared to say whether or not these reactions are specific.

"(2) The glycerine extract of this organism used by them did not produce a skin reaction on leprous or tuberculous patients, nor on normal persons.

"(3) They treated these same leprous patients for two and a half months with a soap solution of leprous spleen, rich in leprosy bacilli, without noting any improvement in the condition of the patients.

"(4) They treated cases of leprosy for eight months with injections of atoxyl and also with injections of a mixture of sodium cinnamate and mercury cinnamate, without noting any improvement in the patients.

"(5) They treated cases of leprosy for eight months with injections of Nastin B. These patients already had been treated with injections of Nastin B for nine months by Dr. Teague. At the end of the seventeen months, no improvement was noted."

## THE PLAGUE CONFERENCE.

[REUTER.]

(*Continued from p.* 148.)

THE International Plague Conference is over, but the interim report presented to the Chinese Government, consisting of a summary of the evidence prepared by the Editorial Committee, and a series of resolutions upon various subjects drafted by sub-committees and submitted to the Conference in plenary sessions for approval, is not to be made public until the complete record of the Conference is published. In the meantime, however, it may not be inopportune to summarize briefly the evidence laid before the Conference.

There are strong grounds for believing that the popular theory according to which the inception of the epidemic was due to infected tarabagans is correct. The American delegates have shown not only that this animal is extremely susceptible to plague, but that it suffers from a form of sub-acute or chronic plague, which may give a clue to the cause of the disease being endemic in North Manchuria and Mongolia. Only one case has been reported in which a rat was found to be plague-infected during the Manchurian epidemic, though upwards of thirty thousand rodents were examined by the Chinese and Japanese authorities. One dog is reported to have died of plague in Dairen, and there are cir-

cumstantial accounts of infection among mules, which are believed, in some instances, to have carried plague into previously uninfected villages. Though climatic and other natural influences may have contributed directly or indirectly to the decline of the epidemic, the chief factor in its eradication appears to have been the drastic preventive measures taken by the Russian, Japanese, and Chinese authorities. It has been conclusively demonstrated that there was no decrease in the virulence of the bacillus during the later stages of the epidemic, and evidence has been adduced to show that even in small villages and hamlets the devastation wrought by pneumonic plague frightened the inhabitants into taking crude, but nevertheless, effectual precautions.

The only definite evidence produced in regard to the spread of infection supported the theory that the disease was introduced into every centre by the arrival of persons actually suffering from plague, or incubating the disease. There has been no trustworthy evidence to show that pneumonic plague can be carried by clothing or merchandise, or by vermin. A series of interesting experiments performed by the Japanese and American delegates may be taken to prove conclusively that the breath of the sufferer is not infective apart from particles of sputum expelled by coughing, or possibly by forcible speaking. The sputum is infective so long as it remains moist or frozen, and it has been suggested that dust can only carry infection by acting as the medium for small particles of moist or frozen sputum. Houses need not be regarded as infective apart from the presence of infected sputum. The incubation period of pneumonic plague appears to vary from about two days to seven days, but is usually three to five days. No types of plague have been encountered other than primary pneumonic, or pneumonic and septicæmic combined. By some experts the pulse is regarded as the earliest diagnostic sign; by others, including Professor Zabolotny, the temperature is relied upon. The absence of marked physical signs in the chest during the early stages renders diagnosis difficult. Prognosis is unfavourable, less than five recoveries having been recorded. In regard to the value of prophylactic inoculations with vaccines there has been considerable difference of opinion, but it seems to be generally conceded that the value of plague vaccines and sera during a pneumonic epidemic is doubtful.

The foremost delegates at the Conference have been Dr. Strong (America), Professor Zabolotny (Russia), and Professors Shibayama and Fujinami (Japan). Professor Kitasato has taken but little part in the discussions.

*Pekin,*
*May* 2, 1911.

# Personal Notes.

## India Office.

*Arrivals Reported in London.* — Lieutenant-Colonel F. J. Drury, I.M.S., B.; Lieutenant Colonel C. T. Hudson, I.M.S., B.; Major P. P. Kilkelly, I.M.S., B.; Captain H. W. Illius, I.M.S., B.; Lieutenant-Colonel W. W. White, I.M.S.; Captain Brierley, C.I., I.M.S., B.; Major C. Donovan, I.M.S., M.; Colonel W. O'Hara, I.M.S.; Colonel F. C. Reeves, I.M.S.; Captain W. D. Wright, I.M.S.; Major B. R. Chatterton, I.M.S., B.; Major E. D. W. Greig, I.M.S.; Captain F. B. Shettle, I.M.S.; Major G. Y. C. Hunter, I.M.S., B.; Captain W. L. Trafford, I.M.S.

*Extensions of Leave.*—Captain C. A. Sprawson, B., I.M.S., 1 m., M.C.; Captain J. Cunningham, I.M.S., 7 m.; Captain E. O. Thurston, I.M.S., B., 7 days.

*Permitted to Return.*—Captain C. A. Sprawson, B., I.M.S.; Captain F. W. Cragg, I.M.S., M.

## List of Indian Military Officers on Leave.

*Showing the Name, Regiment, or Department, and the Period for which the Leave was granted.*

Anderson, Captain D. N., I.M.S., to July 24, 1911.
Grieg, Major E. D. W., I.M.S.
Maunsell, Captain E. C. C., I.M.S., 19 m., from February 23, 1910.
O'Hara, Colonel W., I.M.S., to June 6, 1911.
Reeves, Colonel T. C., I.M.S., 7 m, 10 d., from March 21, 1911.
Shettle, Captain F. B., I.M.S., 8 m., from March 23, 1911.
Trafford, Captain W. L., I.M.S., 1 y., from March 14, 1911.
White, Lieutenant-Colonel W. W., I.M.S., 1 y., from February 26, 1911.
Wright, Captain W. D., I.M.S., 1 y., from March 24, 1911.

## List of Indian Civil Officers on Leave (including Military Officers under Civil Rules).

*Showing the Name, Province, and Department, and the Period for, and Date from, which the Leave was granted.*

Brierley, Captain C. J., I.M.S.
Chatterton, Major B. R., I.M.S.
Donovan, Major C., I.M.S., 8 m., December 16, 1910.
Drury, Lieutenant-Colonel F. J., I.M.S., Principal, Medical College, Calcutta.
Hudson, Lieutenant-Colonel C. T., I.M.S., Bo.
Illius, Captain H. W., I.M.S., U.P.
Kilkelly, Major P. P., I.M.S.
Williams, Captain H. A., D.S.O., I.M.S., 24 m., February 18, 1911.

## Colonial Civil Service.

Dr. G. D. Freer, Senior Medical Officer, Selangor, has proceeded on nine months' leave.

Dr. A. J. McClosky has become Senior Medical Officer, Selangor, Negri Sembilan, and Pahang, during the absence on leave of Dr. G. D. Freer.

Dr. H. W. A. Kay has been selected for the office of Medical Officer for the Northern Transvaal.

Dr. E. J. Kelleher, Medical Officer, Southern Nigeria, has been placed on temporary pension.

Dr. J. H. H. Harrison, Colonial Surgeon, British Honduras, has left the Colony on six months' leave of absence.

## "The Journal of the American Medical Association," April 29, 1911.

*Oriental Sore.*—Darling and Connor describe a case of Oriental sore (dermal Leishmaniosis) in a native Colombian working in the canal zone of the Panama Canal. He had lived in Panama for twenty-two years, so the infection must have been acquired there. The ulceration or sore occurred in the left ear, and was supposed to have followed a fly bite in that situation. *Leishmania tropica* parasites were found, and the etiology of the lesion thus demonstrated. The authors state that this is the third case reported in the canal zone to date. Very probably, when carefully looked for, others will be found.

# Recent and Current Literature.

*A list of recent publications and articles bearing on tropical diseases is given below. To readers interested in any branch of tropical literature mentioned in these lists the Editors of the* JOURNAL OF TROPICAL MEDICINE AND HYGIENE *will be pleased, when possible, to send, on application, the medical journals in which the articles appear.*

### "Edinburgh Medical Journal," May, 1911.

*Tropical Cases in Edinburgh.*—Major Marshall, I.M.S., writes on some interesting cases of tropical diseases seen in Edinburgh during 1910. Malaria, filarial fever, blackwater fever, leprosy, beri-beri, sprue, dysentery, and liver abscesses were amongst some of the diseases treated. In association with Dr. Gunn, Major Marshall tried a new drug in the treatment of malaria, viz., *harmaline*, an alkaloid prepared from the seeds of *Peganum harmala*, the "wild rue" of the ancient Greeks. The pharmacological action of this alkaloid is supposed to be practically identical with that of quinine. The number of cases in which the drug was tried was too small, however, to allow of definite conclusions being drawn. Further trials might be of interest.

### "Indian Medical Gazette," April, 1911.

(1) THE TREATMENT OF ORIENTAL SORE.

Captain H. H. Broome, I.M.S., has used $CO_2$ snow with success in the treatment of Oriental Sore in a sore on his own hand in which Leishman-Donovan bodies were proved to exist, and after failure to cure the sore by as many as nine exposures to X-rays. After the $CO_2$ snow was applied firm pressure was made, and forty seconds given to the centre of the sore as it was very thick, and twenty-five seconds only to the edges. Captain Broome has applied the snow in ten other cases with apparent success.

(2) THE LIGHT FOR EYE WORK.

Captain F. W. Sumner, I.M.S., describes a simple plan for making a room suitable for eye operations in India. His description is as follows:—At some little distance from the side window, should be arranged a vertical expanse 20 ft. by 20 ft. in which the sun may shine, a wall if present answers the purpose best or a screen, after the fashion of a large target, may be erected; whatever it is, it should be well whitewashed; if the window overlooking it faces to the north, this wall and screen will be brilliant white most of the day. The operator arranges his table close to the window and fixes a laryngoscopic mirror on to his forehead, getting it at the correct angle to reflect the light from the white surface on to the patient's eye, when he is occupying the position he proposes to occupy, when performing the operation. He then proceeds with the operation.

(3) THE EXAMINATION OF THE FÆCES FOR OVA OF INTESTINAL PARASITES.

Captain J. Taylor, I.M.S., finds the following method of preparing stained specimens of ova in folds for examination most satisfactory and rapid, and superior to the usual method of examining unstained films.

(1) To a teaspoonful of fæces add 1½ oz. of water or saline solution in a conical glass. Break up the fæces thoroughly and allow to stand until the solid matter settles. Pipette off the supernatant fluid and add more saline solution and again mix and allow to settle. Repeat this a third time. If a centrifuge is obtainable it may be used to hurry the sedimentation.

(2) With a pipette pick up some of the solid matter from the lowest layer of the deposit and make several moderately thick smears on slides.

(3) Dry and fix the smears by heat.

(4) Stain for fifteen seconds with the following solution:—

| | |
|---|---|
| Orange G. .. .. .. .. .. | 4 gr. |
| 4 per cent. solution of acetic acid .. | 100 c.c. |

(5) Wash in water.

(6) Dry thoroughly by heat.

(7) Mount in Canada balsam.

If permanent specimens are not wanted, the dried stained film is smeared with cedar oil and examined without a cover glass.

The clearing with cedar oil or mounting in balsam is essential, and makes a wonderful difference in the appearance of the film, the mass of refractile material usually present in the uncleared film disappearing almost entirely from view.

### "The Journal of the American Medical Association," May 6, 1911.

*Sporotrichosis.*—Harker reports another case of sporotrichosis in man. He believes that the malady is a common one in the Mississippi Valley. Mistakes in diagnosis are often made and the patients subjected in consequence to needless surgical operations. Usually there has been a traumatic lesion of the arm, forearm, or leg which proves resistant to ordinary surgical treatment and is accompanied by the development of one or more sharply circumscribed, painless, cutaneous or subcutaneous, abscesses along the course of a limb. No streptococci are found in the lesions, and this ought to arouse one's suspicions. Potassium iodide is the treatment.

### "Lancet," March 18, 1911.

Recently an epidemic of Asiatic cholera prevailed in the island of Madeira. Since March 1, however, no further cases have been reported, so the disease may be said to have come to an end. The above number of the *Lancet* contains completed statistics of the outbreak.

The first cases are believed to have occurred about the middle of October; and in the four and one-half months during which the epidemic prevailed, there were reported 1,769 cases with 556 deaths. In 75 per cent. of the cases, the onset was acute; in 25 per cent. it was gradual. Ten per cent. of those attacked were known to be habitual alcoholics, though it does not appear that alcoholism is more a predisposing factor in this infection than in any other. The duration of the disease was from three to ten days. In a few cases the acute attack was succeeded by a chronic typhoidal condition. Numerous healthy cholera carriers were observed. With proper sanitation and quarantine, however, it would seem that the disease should be as controllable and preventable as typhoid fever.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# Original Communications.

## RECURRING KERATITIS CAUSED BY TRYPANOSOMES.

By C. W. Daniels, M.B.(Cantab.), M.R.C.P.(Lond.).

So much of the eye trouble that occurs in trypanosomiasis is attributed to the treatment and particularly to powerful arsenical compounds used, that it may be of interest to record eye lesions that can be directly attributed to the infection and that promptly yield to specific treatment.

A brown dog was inoculated with trypanosomes of a Rhodesian strain on September 10, 1910. The parasites were found in the blood a fortnight later.

Up to December 30 it was treated by injections of 1½ gr. of arseno-phenyl-glycin once a week. The trypanosomes disappeared and the dog was lively and in good health. The treatment was then discontinued and the parasites reappeared by January 13, and the dog was obviously in ill-health.

First relapse no eye symptoms.

Treatment was resumed for seven weeks, 3 gr. of the same compound being given each week. No eye symptoms and the dog appeared to be in good health during that period.

The treatment was then discontinued, and on March 13, trypanosomes were again found. Second relapse. Three days later there was milky opacity of both corneæ without conjunctivitis. This completely cleared up in five days under two 1½ gr. doses of the drug.

The arseno-phenyl-glycin was then continued in 3 gr. doses, once a week, but on April 10, trypanosomes were again found, and two days later the keratitis recurred. Third relapse and the second with keratitis. On May 10 it again had trypanosomes in the blood and the keratitis, which had completely cleared up, recurred. Fourth relapse and the third with keratitis. Two doses of 3 gr. of the same drug were given in the following week, the trypanosomes disappeared and the eyes rapidly cleared, leaving some milkiness in the lower half of the cornea, which disappeared more slowly than in previous attacks. With the exception of the times when the trypanosomes are present the dog appears to be in good health and well nourished.

Keratitis has been recorded before in lower animals, and seems to be specially common with the Rhodesian strain of the human trypanosome, but I am not aware of any recorded case in which the relation between the recurrences of the parasites and keratitis is so definite. I have avoided calling the trypanosome *T. rhodesiensis* (Stephens), because the morphological differences in rats, described by Stephens, are so rarely found in this strain, but the clinical differences in man and rats are much as he described them in a case under observation in Liverpool, and in the cultures from it. The appearances of the cornea resemble those in interstitial keratitis.

## A CASE OF TETANUS—TWO SEVERE RELAPSES, DUE TO DEVELOPMENT OF "LATENT OR DORMANT" SPORES.

By Lawrence G. Fink, M.B., C.M.(Edin.).

*Civil Surgeon, Myaungmya, Burmah.*

Sepoy Theja Singh, 20 years of age, belonging to the Peyawbwe Military Police Battalion, was admitted into the Out-post Hospital, Kamaing, Myitkyina District, on December 30, 1908, suffering from a severe attack of tetanus. He was an extremely well-developed man and spent his spare time in gardening. Cow's manure was being used by him in his garden. On examination by the Sub-Assistant Surgeon, a small sore was found on the inner side of the left leg, just above the ankle, and a small lacerated wound on the dorsum of the right foot. His temperature was normal, pulse 66. He was placed in a dark room, the wound and sore having been immediately incised, scraped, cauterized with pure carbolic acid, and an antiseptic dressing applied. When the spasms were very severe an injection of morphia was given and occasionally inhalations of chloroform. Chloral 20 gr. and pot. bromide 30 gr. in mixture were given every three hours. The Sub-Assistant Surgeon immediately wired to me for anti-tetanic serum, which was despatched at once and reached Kamaing the following evening. At 7 p.m., on December 31, 1908, 20 c.c. of the serum was injected subcutaneously. The spasms had been very severe and frequent that day and continued with slight improvement the whole of the following day (January 1, 1909), when one injection of serum, 10 c.c. was given at 9 a.m., and another at 3 p.m. On January 2, 1909, one more injection of serum, 10 c.c., was given and chloral and carbolic-acid mixture, started the previous day, was continued, three doses in the day. On January 3, 1909. the number of fits was reduced to about four per hour and the patient slept off and on from noon till 7 p.m., when the fits again began to be very severe. At 9.45 a.m. and 8.10 p.m. he had been given 10 c.c. serum. On January 4, 1909, he seemed decidedly better and the spasms were slight. Bromide, chloral, and carbolic acid were still continued and mag. sulph. in concentrated solution given to open the bowels. 10 c.c. serum was also injected at 11 a.m. On January 5, 1909, there were no fits, but the patient complained of agonizing pains all over the body. On January 6, 1909, the patient was very weak, at 7 p.m. he had a rigor, and at 11.30 p.m. the temperature was 103.4° F. There were no fits, but breathing was difficult and the patient very restless. Chloral mixture had been continued, quinine sulph. gr. 10 was injected and cold applications made to the head to reduce the temperature. On January 8, 1909, the temperature was normal, the patient had slept well after midnight and no fits had occurred. Quinine grs. 10 in pill was given thrice and the chloral mixture continued every four hours. From January 9, 1909, to February 1, 1909, there was no fever, but the

patient was troubled with constipation and pains in various muscles, but this gradually wore off. Quinine and chloral were given for a few days by the mouth and sulphate of magnesia whenever the bowels were constipated. On February 2, 1909, the evening temperature was 104° F., preceded by rigors, and the patient complained of severe headache and was very restless. The temperature was normal the next morning and never rose again. Quinine sulphate, gr. 10, thrice daily was given in mixture till February 12, 1909, and then the dose was reduced to 2 gr. The patient continued in bed, due to weakness. On February 19, 1909, it was discovered that the man had loss of sensation in his left leg and did not feel the prick of a pin. On February 24, 1909, he complained of formication of the leg and the muscles were very weak and flabby compared with those of the right leg. On February 20, 1909, there was pain in the region of the left knee-joint, but no swelling or inflammation. This pain prevented the patient from leaving his bed, and on April 25, 1909, when he arrived at headquarters (Myitkyina), he was not able to walk without the help of a stick. There had been no recurrence of fits at Kamaing, so he was transferred to Myitkyina. On April 23, 1909, he left Kamaing, and the same evening he had a slight tetanic paroxysm. On April 25, 1909, when he arrived at Myitkyina he was unable to fully extend his left leg, due to severe pain in the knee-joint, especially on the back and inner side, where it was very tender on pressure. At 9.30 p.m. and at midnight he had slight fits. Chloral and bromide mixture was given. There were no more fits, but the pain at the knee continued to be severe for the next few days. At noon on May 4, 1909, there was a very severe relapse, and five men were required to hold him down during the convulsions. Chloral and bromide mixture was again given and anti-tetanic serum wired for. On the 5th, 6th and 7th the patient continued to have frequent severe fits, which were said to have been similar to those he had had at Kamaing. On the 7th the serum arrived and 15 c.c. was immediately injected in the lumbar region. On the 8th the fits were less severe and 10 c.c. serum was injected at 8 a.m. On the 9th and 10th 10 c.c. was injected on each day, but, as the supply had run out, no more was given till the 13th and 14th, when a similar dose was injected. The fits stopped on the 9th, after the third injection, but the patient complained bitterly of general muscular pains and especially of the pain in the left leg and knee-joint. The patient remained in bed till the end of May. His general health improved and the pain in the leg very slowly decreased. On May 31, 1909, he was able to straighten and lift the affected leg, but could not bear his weight on it. As the damp weather was now commencing at Myitkyina, it was considered advisable to transfer him on May 31, 1909, to the dry climate of Pyawbwe. When he arrived there he was admitted into hospital, as his left leg and knee were still painful. On July 2, 1909, he had another very severe relapse of tetanus. Anti-tetanus serum was obtained on July 5, 1909, and 10 c.c. injected that evening, and another two doses, 10 c.c. each, the following day, after which the fits ceased. On July 7, 1909, he received two more injections, 10 c.c. each, and a similar injection on July 8, 1909. On August 5, 1909, the patient, who had had no further relapse, was granted six months' sick leave to India. On December 8, 1909, the Sub-Assistant Surgeon who had treated him at Pyawbwe informed me that he had heard that the patient was keeping good health and had had no more fits.

This case has several interesting features. The sore above the left ankle was probably the site of inoculation and the original "local manufactory of the poison" (Allbutt). By free incision, scraping and application of carbolic acid and an antiseptic dressing, an attempt was made to destroy the bacilli at the probable site of inoculation. In the absence of a bacteriological examination of the tissues it is not possible to say whether the bacilli were actually present at the time in the sore or wound, and, if so, whether the bacilli and their spores had been effectually destroyed by the local treatment adopted. As there was no question of re-infection, the probability is that the relapses had been caused by "latent or dormant" spores, which, for some reason, had developed into toxin-producing bacilli. The severe pain in the region of the knee-joint would suggest that the spores had probably become located in the glands or other tissues near the joint. In the *Lancet*, dated January 29, 1910, p. 314, reference is made to the investigations made by Drs. Porter and Richardson, who actually found in two cases of tetanus, due to wounds on the foot, that some of the bacilli had travelled upwards and were lodged in the inguinal glands. This discovery has led them to advise that the infected glands should be excised in addition to the usual antiseptic treatment of the primary focus. Vincent is of opinion that the transference of tetanus spores sometimes takes place from one part of the body to another, and, recently, Lt.-Col. Sir D. Semple has stated that most of the spores are destroyed by phagocytosis, but some of them escape and become hidden away in the tissues where they remain for months or years after the wound has healed. The latter authority also finds that these "tetanus-carriers" are in danger of suffering from tetanus (*a*) on the occurrence of circumstances (such as great fatigue, or exposure to extremes of heat and cold) which lower their normal power of keeping at bay the germs which they harbour; (*b*) when the site where the spores are lodged becomes converted into a medium which, from being anærobic and from a failure of phagocytosis, is favourable for the growth of the spores into toxin-producing bacilli; (*c*) when a focus of dead tissue forms in a part of the body at a distance from the site where the spores are lodged. From the history of the patient, as given above, it will be seen (1) that the attack of tetanus at Kamaing began on December 30, 1908, and lasted till January 4, 1909, six days, and

that during the latter five days he had received one dose of 20 c.c. serum and six doses of 10 c.c.; (2) that the first severe relapse commenced at Myitkyina on May 4, 1909 (preceded by slight fits on April 23, 1909, and April 25, 1909), *i.e.*, *four months* after the cessation of the first attack, and that this relapse lasted till May 8, 1909, *i.e.*, five days, and the fits were controlled by one dose of 15 c.c. serum and five doses of 10 c.c. during five days (May 7, 8, 9, 10, 13, and 14); (3) that the second severe relapse occurred at Pyawbwe on July 2, 1909, lasted five days, and the patient was given six injections of 10 c.c. serum on four days (July 5, 6, 7, and 8). This relapse occurred about *two months* after the first relapse and nearly *six months* after the original attack. From these facts it would appear that the spores, which were lying latent at the site of inoculation or in some other part of the body, did not develop into toxin-producing bacilli for some time, and that they were probably re-awakened as the result of the fatigue and change of temperature conditions incident on the transfer of the patient from one place to another. In the after-treatment of cases of tetanus care should therefore be taken to prevent any of the exciting causes of a relapse. Lt.-Col. Sir D. Semple has drawn attention to the fact that hypodermic or intra-muscular injections of quinine cause a local destruction of tissue, and the subcutaneous necrotic area is an anærobic medium very favourable to the growth of tetanus spores, and that transference of spores may take place to these areas from the primary site of infection. The patient throughout did not receive more than one intramuscular injection and this *was on January* 6, 1910. As six to eight days is considered the longest interval for re-awakening the spores, this injection probably did no harm and cannot have caused the first relapse that took place *on May* 4. It must, however, be borne in mind that the incubation period in man and animals may be very prolonged in some cases. Semple has condemned the hypodermic or intra-muscular injection of quinine on the ground that a "tetanus-carrier" may develop an attack of tetanus after such an injection. On the same grounds a relapse may be caused in a person convalescing from an attack of tetanus by quinine injection and should be avoided. The two rises of temperature that the man had, one on January 5, 1909, and the other on February 2, 1909, may or may not have been due to malaria. He was, however, given a fair amount of quinine by the Sub-Assistant Surgeon and the fever did not recur.

As regards the treatment adopted, there is little to remark except that the serum injections appeared to be useful.

Dr. W. G. Richardson has written on the subject of tetanus occurring after surgical operations and has shown that there was not enough evidence that the infection was conveyed by the catgut used nor could the source of infection be traced. One of the suggestions made by him was that the patients were, at the time of the operation, the host of the bacilli. In other words, the patients were "tetanus-carriers" and the "latent" spores developed, as a result of the operations, into toxin-producing bacilli, and an attack of tetanus resulted in the manner suggested by Semple. Recently Salvarsan, or "606," has been used as a specific for syphilis and yaws. Injected hypodermically or intramuscularly, it is said to cause a local necrosis of tissue, and if what Semple says is correct, this may cause tetanus in the case of a "tetanus-carrier." So far as I know, no such accident has as yet been recorded after the use of "606." Dr. W. Sinclair Stevenson has recorded a very interesting case of tetanus in which there was no history of any wound nor was there any abrasion of the skin. The patient was a woman who had recently given birth to a full-time child in an advanced state of decomposition. At the necropsy the uterus was found soft and enlarged. Internally, on the posterior wall of the fundus was a small amount of soft, friable, purulent material, which when examined bacteriologically for the presence of tetanus bacilli, proved negative. Parturition, he says, must have taken place under conditions the reverse of aseptic, and the fact that no tetanic organisms were found is not a matter of much importance, as it is comparatively common for those organisms to be absent from the seat of infection forty-eight hours after the onset of the disease. Was she a "tetanus-carrier" or had the germs been introduced *per vaginam*? If the former, the local necrosis in the uterus may have been the determining cause of the attack of tetanus.

In the Civil and Military Police Hospitals at Myitkyina several hundred intramuscular injections of quinine sulphate or bihydrochloride have been given for malaria without a single accident of any sort and with much benefit in severe types of the disease.

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## THE PATHOGENICITY OF *BACILLUS PYOCYANEUS* IN BRITISH GUIANA.

By E. P. MINETT, M.D., D.P.H., D.T.M. & H.,
*Assistant Government Bacteriologist, British Guiana,*
AND
W. J. DUNCAN, M.B., Ch.B.

THIS organism is of far more frequent occurrence in British Guiana than in England. During the last twelve months I have isolated upwards of thirty specimens and from a great variety of sources, as the appended list will show. It was a comparative rarity to come across the organism in London;

speaking from memory I should say that during my two years in the Bacteriological Laboratory at Guy's Hospital, very few cases occurred indeed, the principal ones being a case of compound comminuted fracture of the tibia and fibula from a motor accident, a mastoid, and an abdominal case. But this organism is apparently much commoner in British Guiana, possibly the explanation may be that it can live through the various stages of development of larvæ and may be widely distributed by the adult insect or imago, as stated by Daniels [1]. If that is so there are abundant opportunities for its spread in Georgetown, swarming as it does with mosquitoes; I have isolated the true *B. pyocyaneus* from various vat waters sent for analysis, also in an analysis of sixty samples of milk it was present in four cases; personally, I am of the opinion that in both water and milk samples the bacillus was of fæcal origin. Both Ford [2] and Houston [3] have worked out its fæcal origin thoroughly.

Its occasional occurrence in the vat waters of the colony can easily be accounted for by the presence in the town of numbers of carrion crows, which frequently carry garbage, &c., up on to the roofs from which the water supply is collected.

Herter [4] has described its occurrence in the intestinal tract of normal persons; I have occasionally come across it myself in fæces of normal children, as also have Calmette and Maggiora [5]. Its association with diarrhœa was noted by Williams and Cameron [6], and with dysentery by Calmette in Tonkin, and Lartigan [7] in New York State. Of the thirty cases here recorded, four occurred in intestinal cases, with marked ulceration of the ileum, and in two cases the ulcers had perforated. In one of the cases, however, it was associated with the true *B. typhosus*, but in the other it was, with the exception of normal intestinal organisms, the only one detected after a long and careful investigation.

I isolated the true *B. pyocyaneus* in two cases whilst at Moorfields, one case being a panophthalmitis after injury, and the other a case of very neglected corneal ulcer coming up for treatment after a long delay. Similar cases are recorded by Sattler [8], and Larnike [9], and according to MacNab, a similar case recorded by Hanke [10] as *B. proteus fluorescens* was really *B. pyocyaneus*. Both of the above cases isolated by me were extremely pathogenic to guinea-pigs.

In a case recorded in the British Guiana Annual for 1910, of *B. pyocyaneus* associated with anthrax, I was unfortunately unable to get any definite history, as in view of Emmerich and Loew's [11] discovery of a ferment-like body "pyocyanase," which they state to have protective properties against anthrax, I was anxious to find out with which organism the patient was first affected.

The following is a brief statement of my cases, in all of which *B. pyocyaneus* was present on *post-mortem* examination, with the associated organisms.

(1) Acute pharyngitis. *B. pyocyaneus, Micrococcus catarrhalis.*

(2) Gangrenous foot, septicæmia, and filarial glands. *B. pyocyaneus, B. coli communis.*

(3) Suppurating filarial glands and pyæmia. *B. pyocyaneus, Staph. albus.*

(4) Sapræmia, ulcerating cervix uteri with a breaking-down fibroid tumour. *B. pyocyaneus, B. coli communis.*

(5) Acute peritonitis, perforated ulcer lower end of ileum. *B. pyocyaneus, B. coli communis, Staph. albus.*

NOTE.—This case was not a typhoid, either clinically or pathologically, and Widal's reaction was negative twice during life.

(6) Cæcal ulceration, liver abscess. *B. pyocyaneus* only.

(7) Lobar pneumonia, purulent pericarditis, and endocarditis. *B. pyocyaneus, Streptococcus.*

(8) Enteric fever, ulceration Peyer's patches typical. *B. pyocyaneus, B. coli communis.*

(9) Diffuse entero-colitis. *B. pyocyaneus, B. coli communis.*

(10) Pulmonary abscesses. *B. pyocyaneus, Pneumococcus.*

(11) Pyæmia, liver abscess, perforating abscess into lung. *B. pyocyaneus, B. coli communis.*

(12) Spreading ulceration of legs. *B. pyocyaneus.*

(13) Perforated ulcer of intestine, acute purulent peritonditis. *B. pyocyaneus, B. typhosus, B. coli communis* (Widal positive).

(14) Acute filariasis, septic filarial glands, psoas abscess. *Streptococcus, B. pyocyaneus, B. coli communis.*

(15) Acute filariasis with suppurating inguinal glands. *B. pyocyaneus.*

(16) Gangrene of lung. *B. pyocyaneus, Micrococcus catarrhalis, Staphylococcus albus.*

(17) Cerebral abscess. *B. pyocyaneus, Staphylococcus albus.*

(18) Acute filariasis, suppurating filarial glands. *B. pyocyaneus, B. coli communis.*

(19) Ulceration of penis, phagedenic condition. *B. pyocyaneus Staph. albus.*

(20) Deep wound in foot, with a localized pocket of pus under cuticle. *B. pyocyaneus, Staph. albus* and *aureus.*

(21) Acute filariasis with suppurating inguinal glands. *B. pyocyaneus, Streptococcus.*

(22) Gangrenous appendix with peritonitis. *B. pyocyaneus, B. coli communis.*

(23) Acute filariasis with suppurating glands. *B. pyocyaneus, B. coli communis.*

Cases 5, 8, and 13 are remarkable inasmuch as they are associated with typical typhoid lesions, although in only one case could *B. typhosus* be isolated, in spite of a most exhaustive search for the same. Serum from Case 5 did not agglutinate the *B. typhosus* in a dilution of 1 in 140 in thirty minutes, although tested twice at intervals of a week. Case 13 did so, but unfortunately Case 8 came in and died before a definite diagnosis could be made and an agglutination reaction carried out. This was unfortunate, as it might have helped to explain Case 5.

| No. | 281 | 822 | 3061 | 2639 | 2544 | 4002 | 2133 |
|---|---|---|---|---|---|---|---|
| Glucose | X | X | X | X | X | X | X |
| Dulcite | O | O | O | O | O | O | O |
| Maltose | O | O | O | O | O | O | O |
| Glycerine | O | O | O | O | O | O | O |
| Dextrose | X | X | X | X | X | X | X |
| Saccharose | O | O | O | O | O | O | O |
| Lævulose | O | O | O | O | O | O | O |
| Inulin | O | O | O | O | O | O | O |
| Raffinose | O | O | O | O | O | O | O |
| Mannite | O to — | O | O | O | O | O | O |
| Salicin | O | O | O | X | O | O | O |
| Galactose | X | X | X | X | X | X | X |
| Dextrin | O | O | O | O | O | O | O |
| Nitrate broth | Reduction to $HNO_2$ | Reduction to $HNO_2$ | Reduction to $HNO_2$ | Reduction to $HNO_2$ | Reduction to $HNO_2$ | Reduction to $HNO_2$ | Reduction to $HNO_2$ |
| Neutral red | No fluorescence | No fluorescence | No fluorescence | No fluorescence | No fluorescence | No fluorescence | No fluorescence |
| Gelatin | Liquefaction no gas | Liquefaction no gas | Liquefaction no gas | Liquefaction no gas | Liquefaction no gas | Liquefaction no gas | Liquefaction no gas |
| Indol | O | O | O | O | O | O | O |
| Potato | Brown | Brown green* | Brown | Brown | Brown green | Brown | — |
| Litmus milk | Loose clot | Acid clot | No acid clot | Acid clot | Clot faint | Acid clot | Acid clot |
| Lactose | O | O | O | O | O | O | O |
| Lead broth | O | O | O | O | O | O | O |
| Morphology | Short bacillus no spores | Do. | Do. | Do. | Do. | Do. | Do. |
| Gram.'s stain | — | — | — | — | — | — | — |
| Motility | Active | Very active | Active | Sluggish | Sluggish | Very active | Active |
| G. P. inoculation | *Nil* † | Died 12 hours | Died 12 hours | Died 12 hours | Died 12 hours | Died 12 hours | Died 12 hours |
| G. P. feeding | *Nil* | *Nil* | *Nil* | *Nil* | *Nil* | *Nil* | *Nil* |
| Milk | Green growth | Do. | Do. | Do. | Do. | Do. | Do. |

* Brown growth, greenish colour diffused in medium.
† Done twice.

| No. | 4077 | 4365 | 2631 | 2284 | 2896 | 4420 |
|---|---|---|---|---|---|---|
| Glucose | X | X | X | X | X | X |
| Dulcite | O | O | O | O | O | O |
| Maltose | O | O to — | O | X | O | O |
| Glycerine | O | O | O | O | O | O |
| Dextrose | X | X | X | X | X | X |
| Saccharose | O | O | O | X | O | O |
| Lævulose | O | O | O | O | O | O |
| Inulin | O | O | O | O | O | O |
| Raffinose | O | O | O | O | O | O |
| Mannite | O | O | O | O | O | O |
| Salicin | O | O | O | X | X | O |
| Galactose | X | X | X | X | X | X |
| Dextrin | O | O | O | X | O | X |
| Nitrate broth | Reduction to $HNO_2$ | Reduction to $HNO_2$ | Reduction to $HNO_2$ | Reduction to $HNO_2$ | Reduction to $HNO_2$ | Reduction to $HNO_2$ |
| Neutral red | O | O | O | O | O | O |
| Gelatin | Liquefaction no gas | Liquefaction no gas | Liquefaction no gas | Liquefaction no gas | Liquefaction no gas | Liquefaction no gas |
| Indol | O | O | O | O | O | O |
| Potato | Brown | Brown | Brown | Brown | Brown green* | Brown |
| Litmus milk | No clot no acid | Clot | Bleached clot | Bleached clot | Bleached clot | Acid clot |
| Lactose | O | O | O | O | O | O |
| Lead broth | O | O | O | O | O | O |
| Morphology | Short bacillus no spores | Do. | Do. | Do. | Do. | Do. |
| Gram.'s stain | — | — | — | — | — | — |
| Motility | Very active | Active | Very active | Active | Very active | Active |
| G. P. inoculation | Died 12 hours | No inoculation | Died 12 hours | Died 12 hours | Died 12 hours | Died 12 hours |
| G. P. feeding | O | Not done | O | O | O | O |
| Milk | Green growth | Do. | Do. | Do. | Do. | Do. |

* Brown growth, greenish colour diffused in medium.

*Abbreviations used in Table*:—X ... Acid — ... Alkaline O ... No change.

The acute filarial glands are also remarkable for the frequency with which *B. pyocyaneus* is present; this is one of the things that first attracted my attention in this colony. This organism must have a great aptitude for migrating about the body to find a suitable nidus, as of all the cases of acute filariasis none had ulcerated through the skin or broken down, so that the possibility of external infection is remote.

My colleague, Dr. Duncan, and myself, working in Georgetown, have recently isolated the true *B. pyocyaneus* from drinking water, contained in a vat, which was believed to have been the cause of a localized outbreak of acute enteritis in the town. But as we also isolated the true *B. dysenteriæ* of the Flexner type from another neighbouring vat, it rather mitigates the value of the investigation as regards *B. pyocyaneus*, although in Lartigan's cases it was apparently the only organism associated with the outbreak.

On p. 165 are shown the tabulated results of our investigation into the general characters of thirteen specimens as regards morphology and motility, together with the fermentation and chemical reactions. The specimens were obtained from a variety of sources, but in every case the organism was that of twenty-four hours' growth on agar only, with a view to obtaining uniformity in all characters as far as possible.

These specimens were also investigated as to their pathogenic properties by injecting 1 c.c. of a saline emulsion of a twenty-four hours' culture into the peritoneum of a guinea-pig, and all Koch's postulates proved in each case.

In only one case, No. 281, was the organism non-pathogenic, the inoculation being repeated twice on separate animals, although the organism was otherwise a true *B. pyocyaneus*, and gave a definite "pyocyanin" reaction, besides agreeing closely with the other organisms in its general and fermentation characters. These were carefully repeated in this case in order to definitely exclude the possibility of the organism being *B. fluorescens liquefaciens*.

$HNO_2$ in nitrate broth signifies that the nitric radicle ($NO_3$) of the $KNO_3$ was reduced to the nitrous ($NO_2$) state as determined by the metaphenylenediamine hydrochloride test.

The production of "pyocyanin" was investigated in the usual way by extracting the blue pigment from an agar culture with chloroform, then adding acetic acid and observing the change of colour to red.

*Post mortems* were carried out on every guinea-pig inoculated, the usual *post-mortem* appearances being an acute peritonitis and enteritis of the small intestine. The organism was recovered from the peritoneal fluid, spleen, liver, and heart blood, under strict aseptic precautions, cultivated on broth and agar, and afterwards proved to agree with the one injected in every particular.

Feeding experiments were also carried out in the usual manner by means of bread soaked in an emulsion of the fresh culture of the *B. pyocyaneus;* in our hands no ill-effects were observed during this experiment, the animals being kept under observation for a period of ten days.

The fermentation reactions were recorded at the end of twenty-four hours' incubation at 37° C., and confirmed at the end of forty-eight hours.

The medium we used for sugar reactions was 2 per cent. peptone water, with 2 per cent. of the sugar added.

Gelatine cultures were made by the "stab" and "shake" methods, incubated at 22° C., and observed after forty-eight hours' incubation, as also were the potato cultures, the latter, however, being kept for seven days to observe the green discoloration beneath the growth surface.

Motility was investigated by observing a hanging drop preparation of a broth culture, incubated at 37° C. for twenty-four hours.

The general morphology was observed by means of carbolic methylene blue stain, and Gram's method was used as a differentiating stain.

As will be observed by reference to the table of results, the organisms investigated closely resemble each other, and as the reactions of any one differing in the slightest degree were repeated twice or three times, we are convinced of the accuracy and uniformity of our statements.

Unfortunately, as our literature in the colony is limited, we have no means of knowing if the general characters recorded here agree in every particular with those observed by other workers, and we have in consequence taken particular care to ensure the exact reactions being recorded as observed.

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## TRYPANOSOMIASIS IN NORTH-EASTERN RHODESIA.

By ALEXANDER BROWN, M.B., Ch.B.,
*Serenje.*

THE following record of two cases of quite recent occurrence of human trypanosomiasis from the Luangwa valley, North-Eastern Rhodesia, supplies further evidence of the rapid spread of this disease in this region.

*Case* 1.—Mwemye sent to hospital at Serenje for examination, having left of his own accord a pro-

scribed area in the Luangwa valley, North-Eastern Rhodesia. The patient declared himself perfectly well and strong, and regarded the examination in a humorous light. He looked healthy, although somewhat thin, with individual muscles rather flabby. He explained his condition as due to hunger.

There was no evidence of heart or of lung disease. Respiration normal. Pulse 80, thin and feeble. Temperature, 96° F. Glands in neck, axillæ, and groin were all enlarged. Those on the left side of the neck were palpable, but not puncturable. Those on the right side were much larger. One in particular was larger than the others, freely movable and very soft, as if it were suppurating. Both tonsils were suppurating.

*Microscopic Examination.*—A little juice was taken from the enlarged glands and numerous trypanosomes were found. Some fields were without, in others 3, 4, and 5.

The blood was then examined and several trypanosomes were at once found in the first fresh specimen. These appeared slender with free flagellum and were exceedingly active.

Noticeable features were the apparent health of the man. He bolted after examination, but has since been found. There is no doubt as to the feeble pulse or low temperature. Thermometer was tested on the dispensary boy and found quite accurate.

The only tsetse fly occurring near Mwemye's home is *G. morsitans*, and he has never been further from it than Fort Jameson. There are infected areas 50 to 60 miles both north of his district—Petauke and Nawalia—but he has never been near either of these.

*Case* 2.—Kawimbi. Sent to hospital, Serenje, because he was ill and in the habit of falling asleep.

When seen first (January, 1911) he had been ill for more than a month. He left his home on the Muchinga mountains and went down to the Luangwa valley four months ago. He travelled south to the Sasare mines, went east to Fort Jameson, then to Blantyre in Nyasaland. On leaving Blantyre to return to Fort Jameson he began to feel ill. He passed through Fort Jameson on his way west to Serenje on the Muchinga mountains. Shortly after he was brought to myself at Serenje.

The patient looked ill and had certain characteristic signs suggestive of trypanosomiasis. He complained of pain in the head and body. There was slight wasting in the lower extremities. He had a dull and heavy look, and turning his head from time to time would close his eyes as if tired. The intelligence of his answers showed that the dull look was not habitual to him. His speech was thick; his tongue had a fine tremor. Anæmia was pronounced. There was no œdema. Pulse 80, small and thin. *Temperature*, 96.2 F.

The glands on the left side of the neck were slightly enlarged, those on the right side very much so. There was no throat or other condition which might have accounted for them as in Case 1.

*Microscopic Examination.*—The fresh blood films showed numerous trypanosomes, with extremely active movements.

Comparative features of interest in these two cases were the low temperature, feeble pulse, and enlarged glands of the right side which were common to both, whilst in No. 17, who showed no signs of suffering, the parasites were more numerous than in No. 2, who was very ill.

On March 16, Mwemye (Case 1) still maintained that he felt quite well; Kawimbi (Case 2) is going steadily down hill at this date.

### *Note on the Trypanosomes.*

By J. Rennie, D.Sc.,
*Aberdeen.*

An examination of a number of blood films stained with Geimsa from these two patients has confirmed the presence of trypanosomes in both cases. In neither are the parasites numerous, although it is correct that they are more numerous in the blood from the apparently healthy man than from the sick. Roughly they may be estimated in the proportion of about 3 to 1. In Mwemye's case apparently dimorphic forms occur slender and stumpy. In both the kinetonucleus is large and the free flagellum long. In some stumpy forms the latter appears short, but whether in such cases the terminal portion is simply obscured is not certain. In Kawimbi's case the parasites seem more of an intermediate type as regards shape, but all seem to possess the long free flagellum.

The species may be either *T. gambiense* or *T. brucei*. The very distinct character of a long free flagellum appears to differentiate the forms seen in both cases from *T. rhodesiense*, n. sp., in which, judging from the figures of this species reproduced in the *Bulletin of the Sleeping Sickness Bureau*, No. 22, p. 399, an extremely short flagellum or its entire absence appears to be a feature.

### "The Sleeping Sickness Bureau Bulletin," May, 1911.

*Sleeping Sickness.*—The sleeping sickness bureau bulletin for May, 1911 (No. 27, 1911, vol. iii), contains the following papers:

(1) Sleeping Sickness in Senegal, (2) Symptoms, (3) Transmission of Trypanosomes, (4) Chemotherapy, (5) Pathology of Lesions of the Cornea and Skin, (6) Trypanosomes without Blepharoplasts, (7) Trypanosoma Vivax, (8) Handbook of the Tsetse Flies, (9) Cultural Studies, (10) Surra, and Other Papers, (11) Sleeping Sickness News; Rhodesia, Northern Nigeria, Casamance, Liberia, (12) Monthly List of References.

### "The Australasian Medical Gazette," March 20, 1911.

*Ulcerating Granuloma.*—Jackson contributes notes on this condition, and gives a series of very excellent photographs. A study of these clearly shows that the disease is similar to that seen in British Guiana and other parts of the tropics. In the same number, McLean also treats of the same subject. His statement that it is difficult to find any medical literature on ulcerating granuloma is, of course, incorrect, and if he had studied the literature in detail, he would have seen that Wise, in British Guiana, first described spirochaetes in this disease. The part these play in the etiology is, however, by no means determined.

Treatment of advanced cases is unsatisfactory; when seen early the part should be completely excised with the knife.

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THE JOURNAL OF

# Tropical Medicine and Hygiene

JUNE 1, 1911.


## COLONIAL NURSING ASSOCIATION.

AT the annual meeting of the Colonial Nursing Association, held in London on May 25, 1911, an encouraging account of the work being done by the Association was given. Sir Frederick Treves paid an eloquent tribute to the work of the nurses sent to the South African Colonies, and Lord Ampthill said that the reports received from many parts of the world were in appreciative and laudatory terms. We have on several occasions drawn attention to the work of this Association, and placed on record the testimony of medical men to the valuable assistance they have received from the nurses in their districts. Some 238 nurses have been sent out by the Colonial Nursing Association, of whom 163 are in Government Service in the Crown Colonies. In hospitals and in private work these nurses are employed, some in towns and some in "up-country" stations, where their presence brings help and encouragement to many a sick man far removed from civilization and home comforts.

The lot of the nurse in tropical countries varies with the locality and environment in which she finds herself. In towns nurses find their surroundings are usually most pleasant; they are well received by the community and their work appreciated; and they have several channels of obtaining recreation open to them. In isolated and up-country districts, however, it is otherwise. Long journeys by often haphazard means of conveyance; no white woman near at hand to associate with; no recreation but perhaps a well-thumbed book or out-of-date newspaper or magazine; suitable food for her patient difficult or impossible to get, and the doctor being perhaps a day's journey off, she has to accept responsibility and undergo corresponding anxiety. If her troubles and discomforts are many, however, the comfort she brings is untold and she has her reward accordingly. In many parts of the Tropics the want of means of recreation is a great detriment to health and endurance. To read books is well enough for a time, but even the most assiduous reader requires something more to relieve the monotony of "jungle life." More especially is this the case with the nurse who has constantly evidence of illness before her, with perhaps the consciousness that it may be her turn next, with nobody to look after her should she get ill. It is well, therefore, that those responsible for sending out nurses should see not only to their bodily equipment, but also do what they can to provide recreation to combat a lonely existence. What can be done?

If the nurse has any taste for sketching, let it be encouraged, not deprecated; if she can play a guitar or even a concertina, see that she takes one with her; fancy needlework will help to pass weary hours, and even cards for patience should not be neglected. Monotony in routine is apt to engender low spirits, to lower the power of resistance to infection, to pave the way to ill-health. The puritanical philanthropist, who freely supports missionary and other charitable work, is apt to condemn such recommendations as smacking of levity and worldliness. The missionary, he may say, should find recreation in administering to the people; the nurse in attending to the sick; and any departure therefrom is viewed askance. The missionary, however, is better placed than the "up-country" nurse, for there is always a mission community, meetings, music, &c., and several forms of pastime to be organized for the children; but for the woman in a nursing camp or small station hospital, sickness alone is her daily companion and her nightly care. In choosing a nurse for colonial work, in the schedule of questions to be answered it would be well to insert such queries as: Have you any hobby? What are your recreations? Do you play any musical instrument? and it would be well for the authorities, other things being equal, to decide upon the nurse who can give positive answers to one or other of these. Another point it would be well for the committee of the Colonial Nursing Association to consider is the age of the nurses selected. The woman of thirty stands a tropical climate better than the woman of twenty-five, and the woman of from thirty-five to fifty best of all. "Too old at forty" has been the reply to several

applicants for posts under the Association. A nurse between forty and fifty years of age is at her very best, experienced in many phases of her work, and settled in her profession. She has arrived at the time of life when she is best suited for tropical life, when she can best withstand disease, and when the "outings" necessary to younger people are not so essential to her welfare. To refuse nurses of thirty-five to forty-five on account of age seems throwing away not only good, but the very best material, and revision in this direction would seem advisable and in the interests of the Association.

It would be useful were our readers to give an expression of opinion in regard to this matter.

J. C.

## Abstract.

### A COMPARATIVE STUDY OF METHODS OF EXAMINING FÆCES FOR EVIDENCES OF PARASITISM.*

By Maurice C. Hall.

This valuable paper deals with the results of a series of tests of the various methods that have been advocated for the examination of fæces for evidence of metazoal infection. These tests were undertaken with the purpose of discovering a satisfactory routine method, which would be capable of general application and which in the shortest time would most surely give indication of an even slight infection in fæces of any consistence and character.

Examinations of fæces are of two kinds: (*a*) naked eye inspection for the adult parasites, whole or in fragments; and (*b*) microscopical investigation for eggs and embryos. The latter is the more important in ordinary work and most influenced by the technique employed. Amongst others Hall enumerates the following known methods of microscopical examination:—

(*a*) *Smear Method.*—This is the method most commonly in use at the present time. A small particle of the suspected stool is picked up with a stick or stirring rod, smeared on a glass slide in a drop of water or salt solution, covered with a cover-glass and examined under the microscope. Hall considers that it is satisfactory provided about ten slide preparations are examined.

(*b*) *The Sedimentation Method* consists in allowing the fæces, if sufficiently fluid, to settle; if they are too solid they are shaken up with a quantity of water and allowed to stand for a little. The supernatant fluid is decanted as long as any matter will float, and the sediment is finally examined.

(*c*) *Burette Method.*—This is merely the above varied by taking off the sediment from the bottom through a stop-cock.

(*d*) *Centrifuge Methods.*—The centrifuge gives a more rapid and certain concentration of material, but opinion does not seem to favour its use in fæcal examinations.

(*e*) *Sieve Methods.*—These consist in the use of one or more sieves to screen out coarse particles of food. Stiles says: "It is sometimes convenient to pour the entire mass through a sieve, rejecting the portion left in the sieve; or to wash the fæces in a sieve, holding the latter under water. As a rule, however, the sieve is not very useful in fæcal examinations.

(*f*) *Filter Method.*—Gasteiger reverses the above method for certain purposes. In his search in the stalls of cattle for eggs of ascaris he soaks manure, straw, &c., in water; filters this through a filter and examines the *residue* for eggs.

(*g*) *Bass's Saline Solution Method.*—If a quantity of infected fæces be put into a nine-tenths saturated solution of common salt and shaken well, all hook-worm eggs will rise to the surface when the fluid has been allowed to stand. A single drop from the surface contains large numbers of ova. The method depends upon the fact that the specific gravity of the egg is lower than that of the solution.

(*h*) *Bass's Calcium Chloride Centrifuge Method.*—A quantity of fæces is mixed with 1 to 10 of water and centrifugalized. The fluid is poured off, and more of the diluted fæces added. The process is repeated so that the sediment is rewashed several times until all matter that can be is removed in this manner. A solution of calcium chloride of specific gravity 1.05 is now used in place of water. This carries off everything having a lower specific gravity. A stronger solution, one of 1.25 specific gravity, is now used, and the eggs rise to the top. A few drops from the surface may be examined, or diluted first with water to lower the specific gravity to below 1.05, when the centrifugalized sediment should contain most of the eggs in the original quantity of fæces.

(*i*) *Garrison's Calcium Chloride Sedimentation Method.*—The stool is repeatedly washed and sedimented and the supernatant fluid decanted for such number of times as is necessary to give a clear supernatant fluid. There then remains a heavy sediment, the specific gravity of which is much higher than that of the eggs it contains. By mixing the sediment with a solution of calcium chloride containing 350 grammes to the litre, which has a specific gravity of about 1.2, the eggs float and the rest of the sediment sinks. The top layer can then be decanted off and examined microscopically.

(*j*) *Pepper's Adhesion Method of Ankylostomes.*—Pepper takes advantage of a stickiness that is the property of the eggs of ankylostomes. Washed and sedimented fæces are put on a slide for a few minutes and then gently immersed in water; after everything else has been washed away the eggs are still found adhering to the slide. By repeating the process numerous eggs may be collected on the same slide. This method does not apply for the eggs of ascaris, trichocephalus, or tænia.

(*k*) *Telemann's Chemical Method.*—By shaking up small portions of fæces in a mixture of equal

* United States Department of Agriculture, Bureau of Animal Industry, Bulletin No. 135.

parts of pure HCl and of ether, then filtering of the larger particles and centrifugalizing the filtrate, three layers will be found in the fluid, viz., an upper layer of dissolved fats in ether, a middle layer of bacteria and small particles in acid and a sediment of cellulose, muscular fibres, &c., in which the eggs are easily to be found owing to the greater degree of concentration. Pfister commends this method, especially for *Bilharzia* eggs.

As a result of a prolonged practical study of the above and other methods, Hall concludes that the attainment of successful results depends mainly upon proper concentration, and that this is accomplished by careful comminution of the fæces, the uses of sieves, sedimentation, centrifuging, and washing in water. He has elaborated a new method, the description of which is quoted here in detail, as the subject is one which deserves attention on account of its practical value to all workers in tropical medicine.

### Hall's Method.

"The writer takes particular care to break up the fæces thoroughly. The method consists in shaking the fæces in a rubber-stoppered, wide-mouthed glass bottle about three-fourths full of water. The entire fæcal sample, up to 4 or 5 oz., is used. It is sometimes desirable to break or crush hard fæcal masses with a stirring rod. It is also sometimes desirable to add shot to hard masses. In such cases the most satisfactory results were obtained with about 100 lead shot having a diameter of 3.8 mm.; shot with a diameter of 8 mm. was not as effective in breaking up fæces, and had the additional disadvantage that it blackened the glass. The use of shot is to be avoided as a rule, for the reason that gross parasitic material is apt to be damaged by it. At first the bottle containing the fæces and water and, if necessary, the shot, was shaken rapidly by hand, but as the amount of fæcal examination in the laboratory warranted the use of a machine for this work, a shaker of the kind used in mixing 'milk shakes' was installed and connected by belting with a pulley wheel fitted on an electric-fan motor. This apparatus is very rapid and effective in its work. The bottles are lifted a distance of 5 cm. and dropped back again at a rate of about 500 times per minute. The same machine operated by hand would doubtless be very good.

### "*Sieving.*

"After having been broken up in this manner the fæces are poured through a set of six brass sieves. The sieves have a mesh aperture ranging from 3 mm. in the largest to about one-fourth of a millimetre in the smallest. They are made by taking tin pans with a bottom diameter of about 6½ in. and sides 2 in. high, cutting out the bottom, leaving a flange near the sides, and soldering on to the flange brass screening with meshes of various sizes.

"The sieves are nested in the order of mesh aperture, with the coarsest on top, and placed in a large porcelain evaporating dish, or a large glass dish. The fæces are poured into the top screen and pass through the screens to the evaporating dish, particles of different sizes being held by the different screens. The use of fewer screens would not be a gain, as too coarse material poured on a screen clogs it. Tap water or normal salt solution is poured in the upper sieve until the water stands in the evaporating or crystallization dish at a level above that of the bottom of the upper sieve. This sieve is lifted and shaken a little until the fine matter has passed through. It is then lifted out and put in a large dish half full of water or salt solution and the matter it contained examined on the screen or washed into the dish. Gross parasitic material is picked out, the screen rinsed, the dish emptied and refilled if the amount of discoloration or trash present warrants it, and the process is repeated with the remaining sieves. The gross material left on the screens is thoroughly cleaned, and the likelihood of wasting time examining citrus pulp vesicles, vegetable fibres, &c., as possible parasites is reduced to a minimum.

"The sediment left in the evaporating dish after removing the finest sieve is poured on to a screen of miller's silk bolting cloth with a mesh aperture of 0.117 to 0.134 mm. and the finer particles washed through into a tall jar. The mesh aperture of this sieve diminishes as the cloth shrinks with use, and in a cloth which has been in use for several months it has diminished to a size of 0.070 to 0.080 mm. Such a mesh is too fine to permit the passage of the eggs of such species as *Fasciola hepatica*. Some No. 120 mesh brass screen has recently been obtained which has a mesh aperture rated at 0.117 mm., but varying from 0.103 to 0.120, according to the writer's measurements. This promises to be a very satisfactory substitute for the bolting cloth.

"When the shot are used, they are poured with the fæces into the coarsest of the brass sieves. They are subsequently poured from the sieve into a Petri dish with whatever coarse fæcal matter may accompany them and the fæcal matter easily removed by a stream of tap water. It might be supposed that fæcal matter of some sort would stick to the shot, but it does not do so. Parasitic material that might adhere can be destroyed by dry heat. Lead shot have the advantage over steel shot that they may be kept in a formol solution without rusting, while steel shot would need careful drying, or else keeping in oil.

"Where small amounts of fæces are used, two pieces of brass tubing, 2 in. in diameter and 1¼ in. high, bevelled to fit one in the other, and the lower one furnished with three projections to hold it on glassware of not over 3 in. in diameter, are used to hold the bolting cloth of the silk sieve, the cloth being caught and held taut by the bevelled surfaces. Where large amounts of fæces are used, and large amounts—not to exceed 4 or 5 oz.—should be used whenever obtainable, two enamelled tin pans, with a bottom diameter of 4½ in. and with the bottom cut out so as to leave a narrow flange, are used in place of the brass tubing. The cloth is

held between the upper flanges of the two tins, and the cloth and flanges held together by four small clothespins of the sort provided with a wire spring to hold the jaws together. This device I also owe to Dr. Cobb. The sieve formed of the tins and the bolting cloth is the right size for use with a jar 10 in. high and 5 in. in diameter. When necessary a soft brush is used to brush the fæces through the fine brass sieves or the silk cloth. Cobb uses a brush for the same purpose. These sieves will work better if water is poured through them or if they are dipped in water before the fæcal matter is poured on.

" The sieves, as well as all other apparatus coming in contact with the fæcal material, are washed promptly with boiling water, the sieves being also scrubbed with a stiff brush. This prevents any parasitic material from remaining to contaminate a subsequent fæcal specimen, and thereby giving inaccurate findings. A microscopic examination of the silk sieve shows that it washes clean very readily, and when rinsed retains very little of the material poured on it. A smear made from the residue on the bolting-cloth sieve showed four eggs in one case where the slide preparation from the centrifuged sediment showed 860 eggs; another smear from the residue on the bolting cloth showed one egg where the slide from the sediment showed 475 eggs. In the latter case, a fair estimate of the amount of material on the cloth and the amount from which the smear was made indicates that there were probably not more than ten eggs left on the cloth, while thousands had passed through it. Those that are left are held by the jelly-like residue obtained at this point, and not because the screen mesh is defective or too small. The writer is not aware of any parasite eggs which are too large in their smaller diameter to pass through a mesh with a diameter of 0.117 to 0.134 mm. The number remaining after clean water has been poured through the cloth into the jar is entirely negligible.

" In working with human fæces, or where dangerous infection may be present, the silk cloth may be kept in a jar of formol solution when not in use. In the course of a large number of experiments nothing has yet indicated that parasitic material from one examination has remained to subsequently contaminate other fæcal specimens. Parasites that might be suspected of remaining after the cloth had been washed in boiling water might be destroyed by prolonged boiling or subjection to dry heat—experiment shows that eggs so treated are distorted or characterized by the formation of air spaces or oily areas—or fresh pieces of cloth could be used each time.

" *Sedimenting and Centrifuging.*

" The fæces which pass through the silk sieve are sedimented with plenty of water in the jar. After decanting, the sediment is transferred to a beaker, and may now be washed if desired. The entire sediment, or as much as seems desirable, is then centrifuged, repeated centrifuging with the addition of fresh material adding to the total centrifuge sediment, and may be washed at this point also, as advised by Pepper (1908) and Bass (1909). The writer sometimes washes the material at both points, the second supplementing and completing the first. It is usually sufficient to wash the sediment in the centrifuge. Bass has called attention to the important fact that a centrifuge should only be run the minimum time necessary to bring down the eggs. This time will vary with different centrifuges. With a centrifuge running 3,500 revolutions per minute Bass allows four to ten seconds. I find this enough time with a centrifuge running 1,230 revolutions per minute. After the material in the two centrifuge tubes is washed in water, one tube is left alone; the water is poured off the other and calcium chloride solution, with a specific gravity of 1.250, is added to the sediment. After centrifuging, a slide preparation is sometimes made from this tube direct. In most cases the top cubic centimetre is pipetted off, shaken up with 14 c.c. of water, and centrifuged. This is the more satisfactory and certain method.

" *Preparation of Slides.*

" By means of a long pipette, a drop of sediment is drawn up from the bottom of the tube in which water alone is used, placed on a slide under a cover glass, and examined with a microscope. A second slide is made from the other tube. This second slide is either made directly from a drop taken from the surface of the calcium chloride solution, or from the bottom in case the top cubic centimetre has been added to water and centrifuged. The second slide is used as a check on the first. It sometimes has fewer eggs, especially when pipetted direct from the top, but it is a cleaner preparation, is easily examined, will sometimes have more eggs, especially if made from the sediment where the top cubic centimetre of the 1.250 solution has been centrifuged with the addition of water, and occasionally throws additional light on the material under examination. The pipettes are rinsed thoroughly, and when dried are heated in a Bunsen flame for a short time to destroy any eggs that might adhere, thus preventing contamination in subsequent examinations."

ADAPTABILITY OF HALL'S METHOD.

The writer does not claim that the method advocated here is the best possible method. It is, however, the method which his experience shows to be the best for routine examinations of various kinds of fæces, after comparative tests with other methods. It serves very well for the fæces of man, and of the carnivora, herbivora, and birds. It is not only of service in examining for worm parasites, but also for coccidia. It has not been tested for other protozoa.

# Reports.

## THE SOCIETY OF TROPICAL MEDICINE AND HYGIENE.

FRIDAY, MAY 19, 1911.

DR. CARNEGIE BROWN read a paper on the present position of the quinine prophylaxis of malaria.

He said that no fact in tropical sanitation had been more completely established, and none perhaps was of greater moment than that anopheline reduction below fever limit had been effected in places where only a few years ago any attempt to exterminate mosquitoes would have been pronounced futile and hopeless. But it was also true that from physical and economic reasons the repression of malaria by thwarting anopheline transmission was in many places still impracticable and in such circumstances prophylaxis by reinforcing human resistance necessarily constituted the principal line of defence. Nay more, the whole trend of recent inquiry and the result of clinical experiment had been to show that at the present day more than ever before the scientific administration of quinine was established as a measure of very great value, and that it was indispensable in the general prevention of the disease.

As was the case in many other aspects of the malaria problem, there was still, however, considerable diversity of opinion as to the value of quinine prophylaxis, and even as to the correct application of the term. Strictly speaking, quinine prophylaxis might be defined as placing the system in such a condition by the administration of the drug that the development of symptoms after a first or fresh infection was inhibited; but in practice no such limit was placed on the meaning, and the term was generally applied to the prevention of relapses (in which the action of quinine is more or less curative) and also to the improvement in the health of a community which followed the quininization of infected individuals, where it acted by removing the source of contagion.

Professional estimation of the value of quinine prophylaxis had indeed varied greatly since the days, long before the discovery of the parasite, when the drug was first used as a preventive. In the Ashanti War, 1873, a daily ration of quinine was issued to all ranks, and apparently the experiment received a fair trial, but it was officially pronounced a signal failure. A similar result was experienced in the Malay War of 1875-76, when it was stated that the men who had taken quinine suffered more severely from malaria than those who had taken none; and, scattered through the annals of tropical medicine, we find numerous other records of unsuccessful attempts to reduce the case incidence of malaria by various cinchona alkaloids in circumstances which would now appear to offer exceptionally promising opportunities for the prophylactic action of the drug. Personally, Dr. Carnegie Brown could recall several such experiences. One, which was carried out with what was believed to be a full measure of precaution against all sources of error, was specially noteworthy. It was made at a small village on a tidal river at Lumut in Malaya—at that time an intensely malarial station—where each man of a detachment of Sikhs, none of whom had recently suffered from fever, was reported to have taken every morning from the date of his arrival seven grains of sulphate of quinine, but before their period of duty—three months—was over, all had had severe malaria, and 8 per cent. of the force had died.

It was impossible at this date to inquire into the reasons of these and many other alleged failures. No doubt there had been serious mis-statements of fact; and it must suffice to say that these conclusions had been entirely discredited by the results of subsequent investigation. In most cases, recent experiments when properly conducted had been completely successful.

In the President's recently published work on the Prevention of Malaria full details were to be found of the methods and results of the general employment of quinine by the Indian, the Italian, the Greek and several other governments. These remarkable experiments in sanitation were therefore familiar to all, and it was unnecessary to do more than instance them here. In 1895 when no quinine was distributed, in Italy the total number of deaths from malaria was 16,464; in 1902, when 2,200 kilos were consumed, it was 9,908; and in 1909, when 23,635 kilos were distributed, it had fallen to 3,463. In the Italian Army, of a total average strength of 205,000, 3,500 men were formerly incapacitated for service every year by malaria, but since the introduction of quinine prophylaxis, that figure had been greatly reduced, and in 1908 there were only 804 cases. Summing up the situation in Italy, Professor Celli stated that in the districts and months of malaria, the prophylactic use of quinine was as necessary as daily bread, and he records the opinion—now fully endorsed by Italian physicians—that the general administration of the drug had had a powerful influence in modifying the severity and incidence of the pernicious form, which was formerly the prevalent clinical type of the disease.

Not only had the tendency to recurrence been markedly diminished, but the graver manifestations of infection had disappeared, and previous prophylactic treatment rendered all forms of malarial fever more amenable to therapeutic doses of the drug.

Continuing, Dr. Carnegie Brown said that still more recent reports showed that it was not only in countries where the general standard of education and intelligence was fairly high that these results could be attained. In Algeria, where facilities for the quininization of the population of malarial districts were introduced so recently as January 1, 1910, the disease had already greatly decreased in frequency and severity, and a system of educative and persuasive measures, combined with an abundant supply of cheap quinine, had had the very best effect on the public health. As a contrast to the Lumut experiment already instanced, and as show-

ing the great value of quinine prophylaxis when detachments of troops, police, &c., are stationed at posts where mosquito reduction is impracticable, the recent case of Ha-tien, a small French military station on the Gulf of Siam, might be cited. The district had always been notorious for extreme insalubrity, and of twenty-nine Annamite soldiers there in 1902, twenty-eight were suffering from malaria. After quininization was begun in January, 1903, there were in that month only fifty-nine days of exemption from duty in a force of forty men, in February fourteen, and in March only two. In August when the quinine was stopped, there was a severe recurrence of fever, but the outbreak was promptly checked by the resumption of prophylactic doses. A State service of preventive quininization had now been organized throughout French Indo-China to the great benefit of the general community, and especially to the effective strength of the civil and military forces.

With regard to the rationale of quinine prophylaxis, the question arose: What really took place when a man who was living in a malarial district was enabled to ward off fever by dosing himself systematically with quinine? Were free sporozoites destroyed on their introduction into the blood stream, or did the drug act only on merozoites? Were both incapacitated from attacking the corpuscles, or were the intra-corpuscular growths of the trophozoite arrested? So far as the sporulating forms were concerned, it was now definitely known that quinine acted in the circulation much in the same way as it did on the microscope slide, and that the rapid disappearance of free merozoites after a dose of the drug was due to the circumstance that, in their very earliest stages, the parasites were much more susceptible to its action. The activity of quinine had in fact been shown to be in inverse ratio to the development of a schizont; but except that it stimulated phagocytosis in a marked degree, practically nothing was known of its action—or, indeed, if there was any action—on sexual forms.

The elimination of quinine from the system had naturally an important bearing on prophylaxis. It had been shown that the length of time during which the drug remained in the circulation was roughly proportional to the insolubility of the salt employed; that was to say, if a full dose of a readily soluble salt was given, excretion began almost at once, and ceased in a comparatively short time after about 70 per cent. of the salt had been cast out by the kidneys. On the other hand, if an insoluble salt was used it did not appear in the urine for nearly an hour, but it persisted for several days, although not more than 40 per cent. or 50 per cent. of the quantity taken could be recovered from that secretion. When the gastric functions were normal, a soluble salt of quinine was quickly changed into acid hydrochloride, but with an insoluble salt the change was slower, and sometimes incomplete. In the first instance excretion of the drug took place almost entirely by the renal epithelium, but a considerable proportion of an insoluble salt passed unchanged through the alimentary canal and could be recovered from the fæces. This invariably occurred when there was achlorhydria, and often when the drug was taken on a full and healthy stomach.

Experience had further shown that, in contrast to its use as a remedy, the best results in prophylaxis were obtained by keeping up a percentage of quinine in the blood; and the general rule of practice now was that a salt which was readily soluble was employed when it was desired to obtain a germicidal effect with rapidity and concentrated effect, whilst if more permanent and protracted action was required, the least soluble was selected. As curative remedies therefore, the acid hydrochloride and bisulphate were incomparably superior to the less soluble salts, while for purposes of prophylaxis the sulphate, tannate, or nucleinate appeared to be most suitable. In making a selection cost was generally a consideration of importance, and it might be noted that while the nucleinate was up to the present expensive, the tannate, sulphate, and bisulphate were amongst the cheapest of the salts. The price of acid hydrochloride was higher—generally about double the cost of the sulphate or tannate.

These principles of prophylaxis were generally agreed, but in practice there had always been considerable divergence of opinion as to the way in which quinine should be administered; and a variety of methods, indicated for the most part by the names of the authorities who had recommended them, was familiar to all. German physicians for instance generally prescribed large doses at considerable intervals. Koch's usual method, and one which he employed with great success at Stephansort and several other stations, was to give 15 gr. on two consecutive days at intervals of eight to ten days; but at Brioni he somewhat modified this arrangement by giving 15 gr. daily for three days, and repeating that dose on every tenth or eleventh day after. Plehn advised one gramme every seven days. On the other hand, American, French, Italian, and British authorities mostly concurred in the view that the best results in prophylaxis were obtained by small doses given regularly every day. Carter, of the Panama Commission, who stated that in the Canal Zone the evidence in favour of quinine as a prophylactic was overwhelming, gave from three to six grains daily, and found that the only drawback was that the malaria rate had been reduced to so low a figure that the men disputed the necessity for taking quinine, and were willing to resume prophylactic doses only when several cases of fever had occurred in the camp. In most of the French Colonies, and especially in those in which civilization was less advanced than in older centres, definite instructions were laid down for the quininization of the people by a State Anti-malarial Service, and a considerable amount of pressure was exercised to enforce their regulations. In certain districts of Algeria, for instance, parents and schoolmasters were required to see that children over

three and under ten years of age took 20 centigrammes (about 3 gr.) of quinine every morning from May 1 to November 1; and when local conditions demanded it, all inhabitants above ten years were ordered to take 20 to 40 centigrammes daily. In the instructions of the Anti-malarial Service Board, emphasis was laid on the fact that the important thing was not to take a great deal of quinine, but to take it regularly every day. Professor Celli claimed that the plan advocated by him of giving a moderate daily prophylactic dose of quinine (6 gr. for persons over ten years, or 3 gr. for children under ten years of age) to all the inhabitants of a malarial zone during an epidemic, and therapeutic doses (from 18 to 20 gr. for adults and half that amount for children) for seven or eight days in every case of acute fever, was the most simple, inexpensive, and efficacious method. Where circumstances did not permit of a daily dose being taken, two weekly doses of 15 gr. each (on Saturday and Sunday evenings) were substituted.

British physicians generally recommended the daily administration of 3 to 5 gr., and Castellani advised for adults 5 gr. daily for six days, with a double dose—10 gr.—on the seventh, and for children 1 gr. daily for every three years of age.

By far the most serious objection which had been urged to the prophylactic use of quinine, was the possibility that the routine use of the drug in health might increase the frequency of blackwater fever as a complication, when malarial infection did take place. But a careful examination of the literature and statistics proved that even in countries where blackwater fever was endemic, there was no ground for this serious apprehension. On the contrary, Strachan and others had shown that in West Africa, where almost all the Europeans take quinine as a prophylactic, the case incidence of malaria amongst Government officials was now only a fifth of what it was in 1900 when very few took quinine, whilst that of blackwater fever remained approximately the same. In the medical reports of the German Protected States in West Africa for 1908-09, it was stated that at Dar-es-salem all malaria carriers, 4,578 in number, were given a course of quinine. In most of the cases the course lasted three months, and was carried out as follows: On two successive days of each week adults were given 15 gr. of quinine in tabloids or solution, the medicine being invariably taken in the presence of a European; children received a proportionately smaller dose in a sweet solution. In only four cases was an attack of blackwater fever induced by this treatment; all recovered, and the patients were afterwards put through an acclimatization course of gradually increasing doses of quinine until complete tolerance of the drug became re-established.

In conclusion, Dr. Carnegie Brown thought that the present position might be briefly summarized as follows:—

(1) Quinine prophylaxis was now fully accepted as an auxiliary method of the greatest importance in the prevention of malaria; it was essential in dealing with infected native populations and was specially valuable when (as in the case of detachments of soldiers, railway employees, &c.), general measures were out of the question, individual control and supervision being on the other hand practicable.

(2) When general quininization of a native community was advisable, it should be carried out systematically on an approved plan by a special staff of distributors under a medical director.

(3) The most suitable salts for purposes of prophylaxis were the sulphate, tannate, and nucleinate, and the best method of administration was a daily dose of 3 to 5 gr. for adults, and for children (for whom the tannate was best adapted) 1 gr. daily for every three years of age.

## Drugs and Appliances.

*Hycol.*—Pearson's Antiseptic Co., Ltd., of 15, Elm Street, London, W.C., have produced a new drug termed "Hycol." They claim for this preparation that it is a germicide, a disinfectant, and an antiseptic of guaranteed strength. It has an efficiency 18-20 times greater than carbolic acid, and is non-poisonous and non-corrosive. It has also been tried as a disinfectant for killing fleas and experiments have demonstrated that for this purpose it is very efficient. Three tablespoonfuls to two gallons of water are recommended as the proper strength, and this kills all fleas submerged in it for one minute. It is, in addition, a very powerful bactericide or microbe destroyer, so that its combined characters render it a very valuable agent in such measures as disinfection for plague. Suspected rats, or, as a matter of fact, any dead rats should be immersed in this for two or three minutes so that any fleas or other parasites on them should be killed before a further examination of the carcases is undertaken.

## Notes and News.

*Yellow Fever.*—The preface to a document entitled "Yellow Fever, a Compilation of various publications, results of the work of Major Walter Reed, Medical Corps, United States Army, and the Yellow Fever Commission"* explains the scope

* Sixty-first Congress, 3rd Session, Senate. Document 822. "Yellow Fever: a compilation of various publications. Results of the work of Major Walter Reed, Medical Corps, United States Army, and the Yellow Fever Commission." Presented by Mr. Owen, January 27, 1911. Referred to the Committee on Printing, Washington Government Printing Office, 1911. (In the Senate of the United States, February 17, 1911.—"Resolved, that there be printed, with accompanying illustrations, for the use of the Senate, one thousand copies of the compilation relative to the work of Major Walter Reed and the Yellow Fever Commission."—(Signed) C. G. Bennett, Secretary.)

and object of this work. Briefly, it states that the results of the work of Major Walter Reed, Medical Corps, United States Army, and the Yellow Fever Commission, of which he was President, had been so beneficial and far-reaching that its importance was not to be considered secondary to any other scientific achievement. The various publications in regard to Major Reed and his work and the reports of the Commission, as well as other reports on subjects intimately connected with this work, while all extant and on file in the larger libraries of different countries, were not really available for the profession in general, and so it was thought that being bound altogether in one volume they would be much more available for general use and would be less liable to be misplaced. In compiling these the author states that repetitions have been avoided as much as possible and the reports are all published in full chronological order, so that the various steps in the experiments are more clearly shown. The result of this is a document or book where one can have all the epoch-making work on yellow fever placed together instead of having to wade through endless papers published in different places. The work is illustrated with portraits of the investigators and is a first-class production which all workers on tropical medicine should try to procure a copy of.

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The Incorporated Liverpool School of Tropical Medicine have started a Yellow Fever Bureau, and the first bulletin published by it is now to hand. It is proposed that the bulletin shall appear monthly and it will contain abstracts of papers dealing with the subject of yellow fever, laboratory reports, investigations, yellow fever statistics, and anti-stegomyia measures. Original communications will be received for publication. A sub-committee has been appointed to conduct the Bureau; this consisting of Mr. W. H. Lever, Dr. J. W. W. Stephens, and Mr. Robert Newstead, with two scientific secretaries, *viz.*, Sir Rubert Boyce and Dr. Harold Seidelin. The Secretary is Mr. Milne, and the bibliographer Mr. Dranz. All communications should be addressed to Sir Rubert Boyce, F.R.S., Yellow Fever Bureau, University of Liverpool.

The number or bulletin just issued contains accounts of the recent discussions on the subject of yellow fever at the Society of Tropical Medicine and Hygiene, with much other useful and interesting material. Everyone will wish success to this new bureau. The Sleeping Sickness one has proved of great use and there is no doubt that this one will do the same.

## Annotations.

*The Production of Crescents.*—Dr. David Thomson, in the *Annals of Tropical Medicine and Parasitology*, vol. v, No. 1, April 20, 1911, contributes a very interesting paper on "The Production, Life and Death of Crescents in Malignant Tertian Malaria in Treated and Untreated Cases by an Enumerative Method." His summary of his conclusions is as follows:—

(1) Crescents are produced from the ordinary asexual spores of *P. falciparum*, due to a development of immunity towards the latter.

(2) They develop somewhere in the internal organs and then appear suddenly in the peripheral blood.

(3) The period required for their development is about ten days.

(4) Crescents do not generally live more than a few days in the peripheral blood.

(5) Crescents may be present in the peripheral blood during periods as long as eight weeks, not because the individual crescents suvive for that time, but because their numbers are constantly replenished from surviving asexual forms.

(6) Fresh broods of crescents come into the circulating blood daily, or every other day, or irregularly, according as the asexual sporulations occurring ten days before were quotidian, tertian, or irregular.

(7) Quinine has no direct destructive action on crescents, either during their development or afterwards, but it destroys the asexual source of supply.

(8) Quinine reduces the crescents to numbers less than one per c.mm. of blood within three weeks, provided it be given in daily doses of twenty to thirty grains.

(9) Quinine in small doses tends to increase crescent production (?) by favouring the development of immunity to the asexual parasites.

(10) Methylene blue in doses of twelve grains daily reduces the number of crescents, and would seem to have some direct destructive action upon them.

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*The Swamp Fever of Horses.*—In the *Journal of Medical Research*, vol. xxiv, No. 1 (New Series, vol. xix, No. 1), pp. 213-242, January, 1911, Todd and Wolbach write on a disease called swamp fever in horses. It is found in many parts of the northwest provinces of Canada, and runs an acute or chronic course, its clinical features varying within wide limits. Possibly several diseases are included under the name. It occurs especially in low-lying localities where horses are fed upon hay or grass from the sloughs or swamps. After an exhaustive study of the subject, the authors conclude that the cases studied were too few in number to draw any definite conclusions from. The general results confirmed the observations of others who had studied this disease previously. The disease is usually a chronic one and is characterized by emaciation, weakness, irregular temperature, and anæmia. It is caused by an infecting agent which can be transmitted from horse to horse by the inoculation of blood taken from an infected animal. The authors, although making very large numbers of preparations of body fluids and tissues taken at all stages

of the disease and examined by microscopical and bacteriological methods, failed to find any parasite. It may of course be that the disease comes into the ultra-microscopical group, and filtration experiments to determine whether the virus is still potent after being subjected to such treatment would be useful and probably helpful in solving the etiology of the disease.

*Quartan Malaria in the Canal Zone.*—W. M. James publishes in pamphlet form a paper reprinted from the *Proceedings of the Canal Zone Medical Society*, vol. iii., April to September, 1910, on quartan malaria and its parasite, with especial reference to the occurrence of this form of malaria in the Canal zone.

He believes that quartan malaria as observed in the Canal zone differs from the same disease in temperate climates, in its milder symptoms and more irregular clinical manifestations. He thinks that since the subjects of immunity and relapse in malaria are of great practical and scientific importance, and since quartan malaria furnishes an excellent opportunity to study these subjects, cases of the disease should be recognized and specially observed. In the case of there being a form of the malarial parasite specially associated with relapses, James believes it would be more likely to be demonstrated in quartan than in the other forms, and this is possible.

## Recent and Current Literature.

*A list of recent publications and articles bearing on tropical diseases is given below. To readers interested in any branch of tropical literature mentioned in these lists the Editors of the* JOURNAL OF TROPICAL MEDICINE AND HYGIENE *will be pleased, when possible, to send, on application, the medical journals in which the articles appear.*

### "Transactions of the United Services Medical Society," January to March, 1911.

*Beri-beri, &c.*—Several very interesting papers are contained in the Transactions of the United Services Medical Society for the period January to March, 1911. Fleet-Surgeon R. C. Munday, R.N., for example, read a paper on the different types of beri-beri occurring in naval ships cruising in the Persian Gulf during 1909 and 1910.

There were quite a considerable number of cases of the disease. While the native crews were fed on polished uncured rice there occurred nineteen cases of beri-beri, with seven deaths, amongst crews totalling 182 Asiatic rice-eaters. The clinical symptoms of these cases closely resembled the usual signs of beri-beri as seen in the Malay States. The cases were confined to Asiatics, the Europeans escaping. After this, the Asiatic population being brought up to 317, a staple diet of cured under milled rice was given, and from that time no more unequivocal cases of beri-beri appeared. Two doubtful cases were, however reported, but it was not perhaps definitely clear that these were cases of the disease.

### "Annals of Tropical Medicine and Parasitology," April 20, 1911, Series T. M., vol. v., No. 1.

*Contents.*—The above number contains some very interesting papers, a list of which is appended.

Further Experimental Researches on the Etiology of Endemic Goitre, by Robert McCarrison. Non-ulcerating Oriental Sore: the Cultural Characteristics of the Parasite as compared with a New similar Parasite in *Erthesina fullo* (Thumb), a Pentatomid Bug, by Captain R. Markham Carter. Infantile Leishmaniasis (Marda tal Biccia) in Malta, by A. Critien.—A Research into the Production, Life and Death of Crescents in Malignant Tertian Malaria, in Treated and Untreated Cases, by an Enumerative Method, by David Thomson. — The Leucocytes in Malarial Fever: a Method of Diagnosing Malaria long after it is apparently cured, by David Thomson. Note upon Yellow Fever in the Black Race, and its bearing upon the Question of the Endemicity of Yellow Fever in West Africa, by Sir Rubert Boyce. On the Amoebae Parasitic in the Human Intestine, with Remarks on the Life-cycle of *Entamoeba coli* in Cultures, by H. B. Fantham. Some Further Observations on the Tsetse Fly, described in these Annals as *Glossina grossa*, &c., by Robert Newstead. On the Correlation between Trypanosomes, Leucocytes, Coagulation Time, Haemoglobin and Specific Gravity of Blood, by T. Vishnu Korke.

### "The Bulletin of Entomological Research," May, 1911.

*Entomology.*—The *Bulletin of Entomological Research* for May, 1911, vol. ii., part 1, pp. 1—84, contains the following original articles :—

(1) Diary Notes on the Tsetse Flies observed during a Journey down the Rovuma River, Portuguese East Africa, by H. T. Barrett. (2) A New Mosquito from Uganda, by H. F. Carter. (3) A New Fly of the Genus *Agromyza* from Egypt, by J. E. Collin. (4) The Distribution of Tsetse Flies in the Province of Mozambique, East Africa, by C. W. Howard. (5) A Revision of the Tsetse Flies (*Glossina*) based on a Study of the Male Genital Armature, by Robert Newstead. (6) The Papataci Flies (*Phlebotomus*) of the Maltese Islands, by Robert Newstead. (7) Methods for Detecting Sporozoites and Zygotes in Mosquitoes Infected with Malaria, by Dr. J. W. W. Stephens.

## Personal Notes.

THE SOCIETY OF TROPICAL MEDICINE AND HYGIENE.

At a meeting of the Society held at 11, Chandos Street, Cavendish Square, London, W., on Friday, May 19, 1911, the following gentlemen were elected Fellows: J. G. Dalmahoy Allan, M.B., Hong Kong; K. B. Allan, M.B., W.A.M.S.; Charles H. Brangwin, M.R.C.S., Swatow; Lieutenant-Colonel Percy Carr-White, I.M.S., Rajputana; Robert Chalmers, M.D., Swabue, South China; John T. Clarke, M.R.C.S., F. Malay States; Capt. Charles Cumming, R.A.M.C.; Dr. Mercier Gamble, Matadi, Congo Belge; Captain Cecil M. Goodbody, I.M.S., Bikanir; G. H. Hustler, M.B.Ed., Fiji; Hugh McDougall, M.B., Amoy; S. O. McMurtry, M.B., Honan; James L. H. Paterson, M.B., Wuchang; G. Peake, F.R.C.S.Ed., Parkstone; Lieutenant-Colonel W. H. B. Robinson, I.M.S., Bombay; Paul J. Todd, M.B., Canton; James M. Wright, M.D., Kwong Tung, South China.

## Notices to Correspondents.

1.—**Manuscripts sent in cannot be returned.**

2.—**As our contributors are for the most part resident abroad, proofs will not be submitted to those dwelling outside the United Kingdom, unless specially desired and arranged for.**

3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.

4.—Authors desiring reprints of their communications to the JOURNAL OF TROPICAL MEDICINE AND HYGIENE should communicate with the Publishers.

5.—Correspondents should look for replies under the heading "Answers to Correspondents."

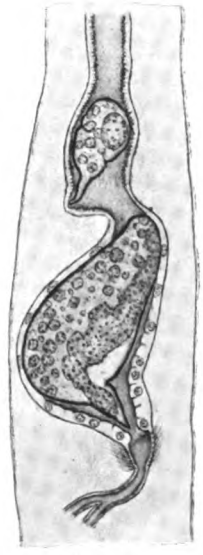


FIG. 1.

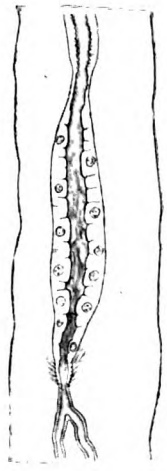
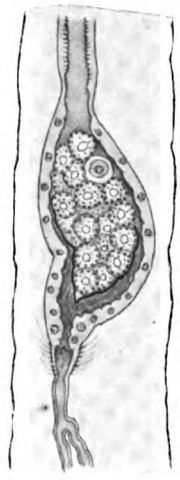
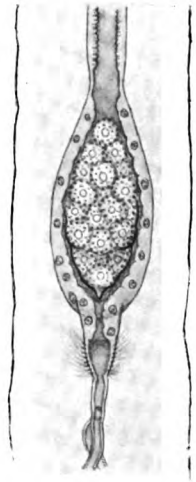


FIG. 2.



*a*



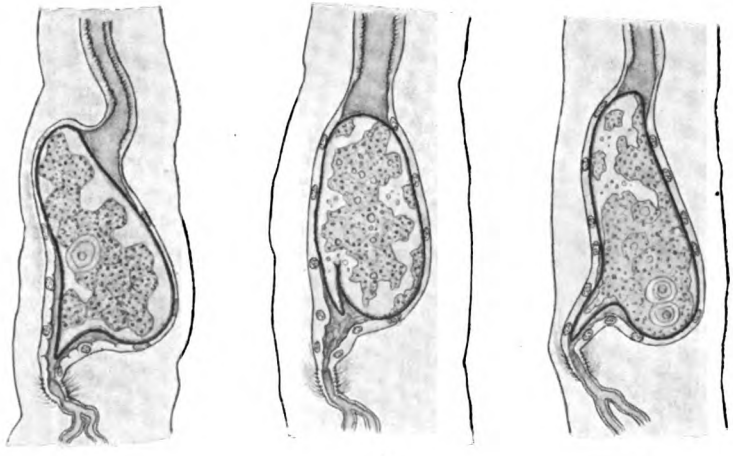
*b*

FIG. 3.

FIG. 1.—Right side view of the ootype of a fertilized female, enclosing a ventral spined egg with abnormal contents, while another, smaller "egg," with a long, terminal appendage, lies immediately in front, in the hindmost portion of the uterus. Camera drawing.

FIG. 2.—Left side view of a fully stretched ootype in its virginal condition. The posterior funnel shaped portion and the bulging of the dorsal wall are recognizable though little pronounced. Camera drawing.

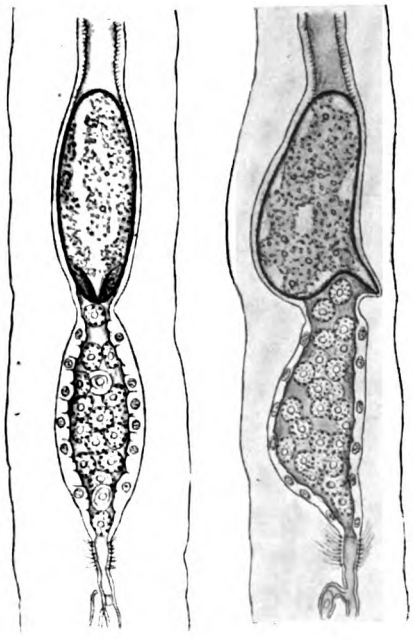
FIG. 3.—Ootype of a fertilized female with the first terminal spined egg in course of formation, the shell being as yet undeveloped in the anterior half. The material of the egg only fills the cavity of the ootype proper; the posterior funnel is contracted and empty, except for the short terminal spine which marks its entrance (the bend in the egg is to all appearance accidental). *a*, left side view, *b*, ventral view. Camera drawings.



*a* *b* *c*

FIG. 4.

FIG. 4.—The formation of the ventral spined eggs in, and their removal from, the ootype. Camera drawings from three different unfertilized females, seen from the left. *a*, the position of the egg during its formation in the ootype; the axis of the egg forms an angle with the axis of the body, the spine points backwards. *b*, removal of an egg with incompletely hardened shell; the funnel shaped portion of the ootype, abandoned by the spine, presents its normal backward direction while the latter lies pressed against the body of the egg; *c*, preparation for removal of an egg with completely hardened shell. The raising into an axial position causes the spine to project ventrally, while taking the funnel of the ootype with it and distinctly bulging even the body surface.



*a* *b*

FIG. 5.

FIG. 5.—Ventral spined egg, after removal from the ootype, in which latter fresh egg and yolk cells begin to accumulate. Fertilized female. *a*, ventral view, to show the perfect symmetry of all parts; *b*, right side view; the ootype has reassumed its original and normal condition; the spine of the egg now bulges the wall of the uterus, and to a slight extent even the body wall. Camera drawing.

To illustrate paper by Dr. A. Looss on the Egyptian *Schistosoma hæmatobium* and allied forms.

FIG. 6.—Mature terminal spined eggs from one and the same urine, to show some of their more common variations in shape and size. *e*, in its lower half, shows a similar bend as seen in fig. 5, *a*, while anteriorly it recalls the conditions of figs. 3, *c* and 7, *b*; *f* shows a distinct ventral displacement of the (noticeably larger) spine, in concomitance with a markedly stronger bulging of the dorsal surface (to be compared with fig. 7, *e*). Camera drawings.

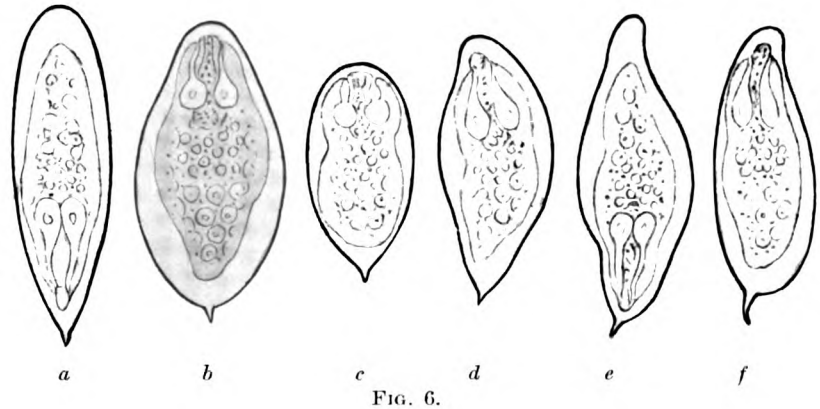



FIG. 6.

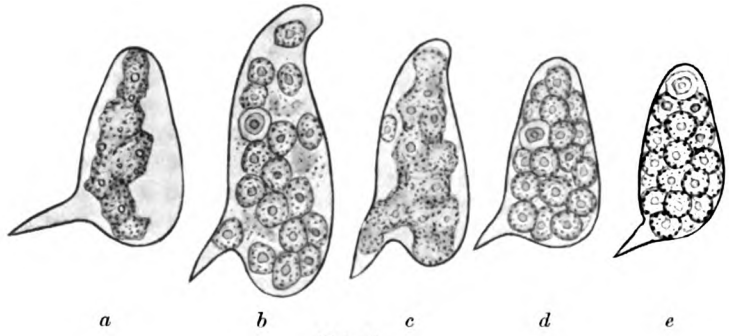



FIG. 7.

FIG. 7.—Various forms of ventral spined eggs from the ootypes of young but fertilized females. *d* and *e* transitory forms to the ventral spined type (for comparison with fig. 6, *f*). Camera drawings.

FIG. 8.—Some eggs of *S. japonicum* from the human liver, to show the principal variations in the position of the "spine" and the 'calotte" opposite it. Camera drawings.

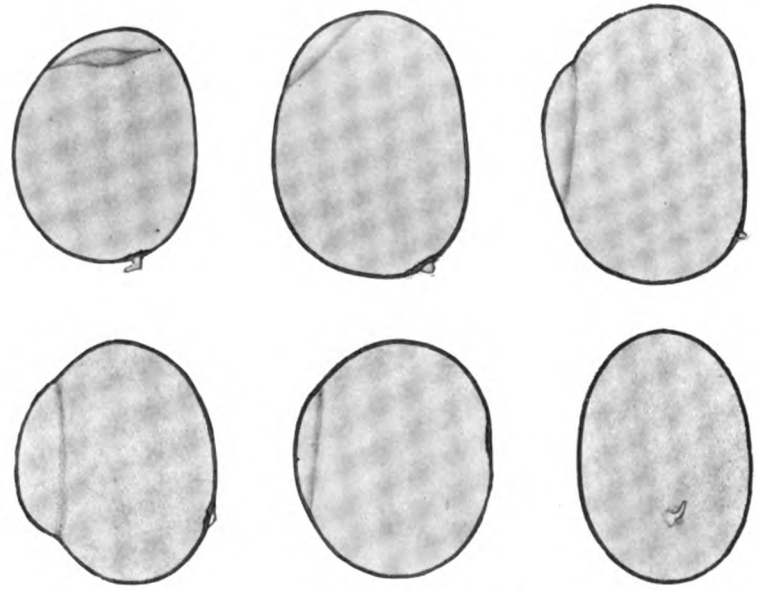


FIG. 8.

FIG. 9.

FIG. 9.—The "spine" of the *S. japonicum* eggs more highly enlarged, to show its variations in shape and relative size. Camera drawings.

## Original Communications.

# SOME NOTES ON THE EGYPTIAN *SCHISTOSOMA HÆMATOBIUM* AND ALLIED FORMS.

By Dr. A. Looss.

*School of Medicine, Cairo.*

In a critical article dealing with the justifiability of "*Schistosomum mansoni*, Sambon, 1907," as a new species, I gave a hypothetical picture of the life history of the Egyptian *S. hæmatobium*, the details of which were all based on facts observed, either by myself or by previous authors. In explanation of this picture I said that "in the absence of experimental proof the only thing the scientific man desirous of advancing our knowledge can do is to collect carefully as many isolated facts as may be obtainable; to separate those which are (presumably) essential from those which are (presumably) accidental, and to piece all of them together into a continuous train of events. This is what I have been endeavouring to do; I cannot imagine that a theory thus built up can be wrong in its fundamentals. It must, of course, be incomplete, or may be erroneous in details." The work here outlined has not been abandoned with the publication of my article. I regret that professional duties have prevented me for nearly two years from giving undivided attention to the subject, yet some new observations have been made in the meantime which enable me, in part to correct, and in part to amplify my former statements. I find it advisable, for various reasons, to publish some of the chief details at present, though the whole investigation is not yet considered as terminated. How far the particulars brought forward affect the premises on which *S. mansoni* is constructed, those interested are invited to decide for themselves. For the convenience of the reader I will here only quote what a report on "The Year 1908" (see Journal of Tropical Medicine and Hygiene, xii., No. 1, January 1, 1909) says with regard to the situation; the passage runs as follows: "A new species of *Schistosoma* was described by Sambon, definitely characterized by the lateral-spined egg, which, even by Bilharz himself, when he first discovered the parasitic agent of bilharziosis, was confounded with the classic species *S. hæmatobium*, characterized by the terminal spine to the egg. The new *Schistosoma*, which occurs together with *S. hæmatobium* in Egypt, is found quite alone in the West Indies and in Brazil. . . ."

In three cases of bilharziosis dissected by Professor Ferguson up to March, 1911, very numerous worms (between 100 and 300 in each case, and comprising both males and females), all still alive, were present in the portal vein. The individuals were for the most part separated; only a few couples occurred. Small coils of worms were also found enclosed in blood coagula of various sizes. Some of these preserved *in toto* and subsequently examined in serial section showed the worms in a similar condition, *i.e.*, in part free, in part copulated—many couples, however, only in so loose a connection that they gave the impression of having been overtaken by the preservation, either in the act of entering into copulation, or in the act of again dissociating. It may here be mentioned in passing that even at their definitive seats the bilharziæ do not seem to lead a strictly monogamic life, females being occasionally found (*in situ* or in serial sections through portions of veins) either quite alone, or free among several males, so that it is impossible to decide to which they belong. With regard to their internal condition, the specimens from the coagula did not differ from those found free in the portal blood. There was no question of their being, in all three cases, half-grown specimens of one and the same species, and this the Egyptian *S. hæmatobium*.

Most of the females had one "lateral spined" egg in their ootype or uterus; a few presented two eggs, none more. One of the latter specimens was particularly interesting inasmuch as the anterior "egg" was small, ovoid, and had a long terminal appendage, while the other, lying immediately behind, was of the usual "lateral spined" type (fig. 1). In some females, the content of the eggs displayed an altogether normal appearance; in the greater majority, however, it looked abnormal, consisting of shrunken or disintegrating "yolk" cells, with or without an egg cell, sometimes with two egg cells instead of one, &c. On close examination it was further found that many females contained spermatozoa in their seminal receptacles; others did not, but in a few of these spermatozoa were discovered in the uterus, *i.e.*, on their way to the seminal receptacle. The presence of eggs did not coincide with the presence of spermatozoa; in other words, of both the fertilized and the non-fertilized females some contained an egg and some did not. So the formation of these eggs had taken place in part before and in part after, the first copulation. I have no reason to doubt that the eggs with the normally-looking content enclosed a fertilized, those with the abnormally-looking content a non-fertilized egg cell, if indeed any was present.

Taken as a whole the conditions described confirm the conclusions which I had drawn from earlier similar observations, namely that young females, before and in the beginning of their normal sexual activity, produce more or less abnormally shaped eggs. I regret that in my former article, replying to a distorted quotation of my views, I mixed the question of the formation of these eggs with the question of their fertilization; in reality, the two questions are independent from one another, except in so far as I still hold the opinion that females which for one reason or another remain uncopulated, *i.e.*, cannot fertilize the eggs which none the less go on developing in their organs, are neither capable of giving them the normal shape. This does not imply, however, that the change to this shape must take place with the very moment of

fertilization; there will, on the contrary, always be a transition period; indeed, my new observations leave no room for doubt that abnormally shaped eggs *may* become fertilized. There is thus no longer any necessity of admitting on the part of the egg cells a capability of developing by parthenogenesis, a consequence which I had myself been obliged to describe as little probable in my former article. The fact that certain "lateral spined" eggs may have a fertilized, others a non-fertilized, egg cell, probably explains the occurrence recorded by many observers of collapsed and empty egg shells in the tissues; these shells being the remnants of unfertilized eggs the contents of which have been disintegrated and absorbed, while in fertilized eggs the miracidia developed, despite the abnormal shape of the shell.

In a case dissected by Professor Ferguson late in March, 1911, the liver (on superficial inspection) seemed to be free from worms, but very numerous specimens (of which some 500 were collected during ten hours' work) were present in the veins of the mesentery, the specimens farthest advanced (but few in number) lying in the small vessels which, starting from the insertion of the mesentery, encircle the intestinal wall on its outside. Many coupled pairs were among them, besides isolated individuals which for the greater part consisted of males. All individuals were of about the same size, and, consequently, of about the same age as those found in the three preceding cases, with the exception of a score or so (pairs and bachelor males), which at once caught the eye by their more considerable size, and on examination proved to be mature and in full sexual activity. No intermediate stages existed between these large and the smaller specimens, although in some places (in serial sections through veins from the close neighbourhood of the intestine) the two lay literally side by side. These large specimens were unmistakably the result of a previous infection. Of the younger females, the great majority, even those collected from the most distant tributaries of the hæmorrhoidal vein, presented internal conditions very much like those above described, *i.e.*, they had one of two lateral-spined eggs (with normal or with abnormal contents) in their genital organs. Only the not yet fertilized specimens were now rare.*

In some individuals there were no eggs, but an almost continuous train of isolated egg and "yolk" cells, obviously on their way out, extended through the whole length of the genital tract. Four of the females (two copulated, the others free, but all fertilized) had the uterus quite empty, but a typical terminal-spined egg, more or less completely formed, was present in their ootype (fig. 3). In several other females the egg had the intermediate

* These specimens therefore exactly resembled others which I had found on a previous occasion and mentioned in a footnote appended to my article while reading the proofs. I added: "This observation shows that the worms may leave the liver before sexual maturity is attained, but otherwise agrees with the theory." The correctness of this interpretation is, I think, fully borne out by the new observations above recorded; I will avail myself of the contingency for showing, by one example only, how part of the "evidence" in support of *S. mansoni* (in its present form) is manufactured; for the rest, the facts above described (and others which may follow) will be my only reply to recent criticisms.

In my article of 1908 I had said that the actual existence of *S. mansoni* would find an important support if somebody could produce females "embedded in the gynæcophoric canal of the males, and the latter embedded in a vein of the rectal wall . . . . . which possessed in their uterus exclusively and as many lateral-spined eggs as the ordinary females possess terminal-spined eggs under the same conditions" (namely 80-150). With reference to this passage, Piraja da Silva, in his article on "La *Schistomose* à Bahia," (*see Arch. Paras.*, Paris, xiii., 1908, p. 281 f.; also JOURN. TROP. MED., xii., June 1, 1909) says: "Dans les coupes de rectum que nous avons faites avec Letulle, nous avons eu la chance de trouver un couple de *Schistosomum* dans une veine de la sous-muqueuse (fig. 8); en examinant l'une d'elles, on voit nettement un œuf à éperon latéral dans une femelle renfermée dans le canal gynécophore du mâle (fig. 11). Or, Looss avait dit qu'il faudrait qu'on trouvât un *Schistosomum* femelle dans le canal gynécophore du mâle et contenant dans son utérus un œuf à éperon latéral et que les deux parasites fussent à l'intérieur d'une veine de la paroi rectale, pour qu'on eût le droit d'affirmer l'existence d'une deuxième espèce de *Schistosomum*. C'est précisément là le fait que nous avons constaté, et qui démontre qu'une femelle, à l'état de maturité, peut pondre un œuf à éperon latéral, ce que l'on n'avait pas pu affirmer jusqu'ici." I will here not dwell on the slight difference which exists between the 80-150 eggs I had demanded, and the one egg found by Da Silva; nor will I dwell on the fact that the specimens he describes exactly tallied with those mentioned by me, and that his find did not therefore constitute any new discovery; let me only consider the actual basis of Pirajá da Silva's conclusions, namely, "l'œuf à éperon latéral qu'on voit nettement dans une femelle enfermée dans le canal gynécophore du mâle." The condition is illustrated by two pictures, apparently reproductions from photographs. On looking at them, anyone who is familiar with the structure and appearance of the Bilharzia worms will be able to tell (1) that the picture said to represent a section through "deux *Schistosomum* en copulation" (fig. 8) shows in reality, not sections of a male and a female, but two sections of a female, one longitudinal and the other somewhat obliquely transversal; (2) that the other picture, said to represent "un œuf à éperon latéral à l'intérieur du *Schistosomum*" (fig. 11) shows in reality not an egg, but an intestinal concretion. In explanation of this latter assertion—the former does not I think need any except a glance at the figure—attention may be drawn, in the first place, to the wide cavity with the distinct epithelial lining, in which the "egg" lies; this is clearly the intestine, for the ootype and uterus have a narrow lumen (the former being in addition lined by a low cuticular layer without nuclei), and neither is surrounded by yolk-glands such as visible in the picture. The "egg" would therefore lie in the intestine; supposing even that its presence at that place could reasonably be accounted for, it would prove nothing as to the sexual condition of the worm. But it is not even an egg, for there is no shell, which otherwise is very sharply outlined, especially in the ventral-spined eggs; the "egg" consists solely of a particularly granular substance and is partly covered by another somewhat smaller and round body of the same structure. Now the latter is absolutely, and the other hardly less, unmistakably a concretion such as I have frequently, and often abundantly, seen in the guts of females, both entire and cut into serial sections. These concretions have a varying size and shape; they consist of a slightly yellowish substance of glassy appearance and foamy or vacuolized texture, and imbibe colours. What their nature is I cannot yet say.

Thus Pirajá da Silva's "proof" of the existence of a "second species" of *Schistosomum* becomes reduced to a combination of several very elementary mistakes; what the conclusions based on such evidence are worth scientifically, every reader is at liberty to decide for himself. But am I to be blamed if I urge that authors, before they write on parasitological questions, should make themselves acquainted with the parasites they deal with?

form depicted in fig. 7*c*. Apart from this deviating shape of the egg, there was no essential difference, either in size, shape, or organization, between all these numerous individuals.

A comparative study of the ootype in rather more than a hundred females from all four cases showed that it was the same throughout. In its virginal state (fig. 2), and in fully stretched specimens, it is a slender, spindle-shaped organ, the posterior portion of which, communicating with the common ovi-vitelloduct entering from behind, is somewhat marked off from the rest in the shape of a slender cone, or funnel, while the dorsal aspect of the anterior portion is slightly more bulged than the ventral. Taken as a whole, this ootype lies somewhat nearer to the ventral surface, but parallel to the axis of the body, a position which becomes clearly visible when the animals are viewed from the side (fig. 2), while, when seen from the dorsal or ventral aspects, the ootype appears perfectly symmetrical and situated in the middle line (fig. 4*a*). This shape and position naturally change with the contractions of the worms, and may additionally change with the individual movements the ootype is capable of making by the help of its double coating of longitudinal and circular muscles. It would lead me too far to enter here into the details of the egg formation*), so I limit myself to the following statements.

The new investigations, consisting in a comparison of numerous eggs enclosed in the ootype or in the adjoining portion of the uterus, confirm my former views in so far as they show that the shape of any egg indeed depends on the position it has in the ootype during its formation; but this position, in its turn, does not solely depend, as I hitherto assumed, on the presence or absence of isolated yolk elements, &c., besides the egg, but chiefly on the bulk of the material to be enclosed in the shell. In the case of normal eggs (fig. 3), no more yolk cells are admitted in addition to the egg cell than just fill the cavity of the ootype proper, while the funnel communicating with the common ovi-vitelloduct remains closed. When this material is transformed into an egg the shell assumes the shape of the ootype cavity, while a little quantity of the shell substance penetrating into the entrance of the funnel subsequently appears as a short spine-shaped prolongation of the shell proper. This latter for a time still remains soft and mouldable; during the normal sexual activity, when eggs are formed in quick succession, they are forwarded to the uterus in this condition and there assume their definitive shape; at any rate, one may easily convince oneself by examination of females with even moderately filled uteri that the eggs still change their shape on their way forwards. If, on the other hand, for some reason or other, an egg remains in the ootype until its shell hardens completely, then it preserves any irregular shape it may have at the time. It appears to me significant that the bend seen in fig. 3*b* was repeatedly met with in a more or less pronounced degree, among eggs voided with the urine (fig. 6*e*) as well as among others obtained by maceration of the bladder wall. In young females, the process of egg formation is not yet regulated; the ovary, and especially the "vitellaria" commence their function at an early period; the products accumulate in the ootype to such an extent that they distend its cavity, bulging in particular the dorsal wall, and fill not only the funnel-shaped posterior portion, but frequently also a part of the short duct connecting the ootype anteriorly with the uterus. When this material surrounds itself with the shell there results the well-known form of the "lateral-spined" eggs, which, in addition to their (usually) larger size, also possess a somewhat thicker shell, due to the larger amount of shell material produced by the more numerous "yolk" cells. The more these latter project into the passage between ootype and uterus the more marked becomes the anterior bend of the shell visible in figs. 7*b* and 4*c*. It is frequently indicated even in terminal-spined eggs (fig. 6*e*). From what has been said above about the situation of the ootype in the body, it is clear that the spine occupies the ventral side of the egg and that, consequently, the "lateral-spined" eggs must accurately be termed ventral-spined. As a consequence of the bulging of the dorsal wall of the ootype caused in its turn by the greater bulk of the material, what appears as the long axis of the egg forms an angle with the axis of the body; hence the slanting position of the egg proper, while the spine enclosed in the posterior funnel retains its axial direction (fig. 4*a*). This oblique position is occasionally so pronounced that the egg seems to lie almost dorsoventrally, the spine then standing off from it at about right angles (fig. 7*a*).

When such a ventral-spined egg is to be evacuated from the ootype, it must first be brought into an upright, *i.e.*, axial position. If this occurs, so long as the shell is still soft, the spine is simply forced backwards so as to lie closely against the shell (fig. 4*b*); obviously, however, these abnormal eggs, as is easily comprehensible under the circumstances, are not formed in quick succession, and their shell usually hardens in the ootype. When in such cases evacuation is to take place the act of raising the egg gives the spine a ventral direction, sometimes to such an extent that it bulges even the body surface (fig. 4*c*). If females in this condition are viewed from the side (they usually assume this position in microscopical preparations, unless particular care is taken to prevent the cover-glass from

* According to recent observations of Goldschmidt, bearing on several species of digenetic Trematodes (see *Zool. Anz.* xxxiv., 1909, pp. 481-498), this process is in reality fairly different from that hitherto assumed. I have no doubt, on the ground of personal experience, that the views propounded by Goldschmidt are correct, and also apply to the Bilharzia eggs. Their chief purport is that the shell is not a product of the so-called shell gland, but is supplied by the "yolk" cells, the granules of which, formerly generally considered as yolk material, are in truth shell substance, and coalesce to form the shell after they have been evacuated from the cells in the ootype. For further details the reader must be referred to the original article.

exerting any pressure upon them), then the common ovi-vitelloduct indeed seems to enter the ootype "laterally." I have unfortunately not yet succeeded in obtaining a copy of Fritsch's paper on the anatomy of *S. hæmatobium*; but I have now little doubt that his statement as to a lateral entrance of the ovi-vitelloduct into the ootype, this feature so much insisted upon as the distinctive character of *S. mansoni*, is due to an erroneous interpretation of the condition described. That this condition is anything but permanent is evidenced by the fact that the funnel-shaped portion in which the spine has been moulded reassumes its axial position soon after this has been withdrawn from its cavity (figs. 4*b*, 5*b*). A connecting link, to my mind unmistakable, between the ventral-spined and the normal terminal-spined eggs is supplied, apart from specimens like fig. 7*e*, by the form reproduced in fig. 6*f*, which is occasionally met with in the urine as well as within the bladder wall. My hope of finding among the material lately examined a female corresponding to that described by Bilharz, *i.e.*, with both forms of eggs in its uterus, has been disappointed, although the conditions shown in fig. 1 are also suggestive enough. I have received the impression that when once the production of normal eggs begins the others are, as a rule, quickly evacuated. But on the ground of the new observations I have less doubt than ever that sooner or later I will be able to confirm the statement of Bilharz, who, in every respect, has proved to be so conscientious and cautious an observer that he may well be recommended as a model to certain modern workers.* That the females of *S. hæmatobium* can, and do, produce the two forms of eggs is beyond question even now, however much the impossibility of the process may be emphasized in order to save a theory.

If this is true, then one ought to expect that wherever one form of egg occurs the other should occur also. Up to the present this did not seem to be the case; at any rate, it was the generally received view that ventral-spined eggs were never voided with the urine, and that, consequently, an important difference existed in the localization of the two forms of eggs. I regret that in my earlier article, when speaking of this common belief, I overlooked the fact that ventral-spined eggs were not only known to occur in the centres of calculi, but that Sonsino even mentioned their actual, though rare occurrence in the bladder wall. Both facts are in themselves as good as proof that the eggs in question must also be *voided from* the bladder. Indeed, I can now formally state that this is the case; ventral-spined eggs do occur in the urine and may do so even in fairly large numbers. Their discovery there is due to Riad Yussef, a talented young student of our school, who, a few days after I had mentioned the matter in the lectures, told me that he had found a hospital patient with ventral-spined eggs in his urine. There was no difficulty in verifying the observation; in order to exclude any mistake, specimens of the man's urine were collected about twelve times within the next three weeks, and their sediments preserved. In all of these preparations the ventral-spined eggs were present, sometimes amounting in number to 10-12 per cent. of the terminal-spined; the variations observed being probably due—in part at least—to the fact that a very heavy sediment of crystals interfered with the proper collection of the eggs. Up to the present moment, Riad Yussef has found three more cases, two of which I was able to verify myself. On the ground of these facts I have no hesitation in asserting that the presence of ventral-spined eggs in the urine will not remain so exceptional an occurrence if they are only duly looked for, especially in cases of slight and comparatively recent infections.*

The necessary condition for their appearance in the urine is their previous presence in the bladder wall. Practical evidence to that effect is implicitly supplied, apart from Sonsino's statement, by the occurrence, unquestioned so far as I am aware, of egg shells, of fragments of egg shells, with ventral spines in the centres of calculi. More recently, entire ventral-spined eggs were again incidentally found in the bladder wall by Ferguson (see *Journ. of Pathology and Bacteriology*, latest number) in two out of forty cases studied with another object in view; while investigations specially made for the purpose by myself (but not yet terminated) have revealed them up to the present in eight out of twenty-three bilharzial bladders selected at ran-

* It has been intimated that it was a false statement (among others) when I made Bilharz say that he once found a female with both lateral- and terminal-spined eggs in its uterus. So let me quote from one of his later works: "Die Eier erscheinen sonderbarer Weise unter zweierlei verschiedenen Formen. Die gewöhnliche Form ist oval, nach den Polen hin etwas verjüngt, an dem einen Ende in ein dünnes Spitzchen ausgezogen. . . . Die zweite, seltenere Form ist von ungefähr gleicher Grösse, an beiden Enden stumpf, an der einen Seite sitzt ein dem stumpfen Ende zugerichteter conischer Fortsatz. Beide Formen wurden sowohl innerhalb des Eileiters der Mutter, als in den Geweben verschiedener Unterleibsorgane des Menschen gefunden" (*Wiener med. Wchschr.*, vi., 1856, No. 4. [Strange to say, the eggs appear under two different forms. The usual form is oval, slightly narrowed towards the poles, and drawn out, at one end, into a thin point. . . . The second, rarer, form is of about the same size, blunt at either end; on one side there is a conical projection directed towards the blunter end. The two forms were found within the oviduct of the mother as well as in the tissues of various abdominal organs of man.]

* With regard to this subject, Dr. Keatinge, Director of the School of Medicine, Cairo, who had kindly consented to read over the present article before it was sent to the press, favours me with the following most interesting note which I insert without further comment. Dr. Keatinge writes: "When serving with the Egyptian Army (1884-1890) I was called upon to examine thousands of conscripts and therefore observed many hundreds of Bilharzia urines. In reading over this paper it came upon me as a great surprise that there was any doubt as to the occurrence of ventral-spined eggs in the urine. I have frequently observed them, although naturally they are of much greater rarity than the eggs with terminal spines. It may be worth pointing out that the conscripts were all quite young men and therefore in all probability many of the infections were of recent date at the time the examinations were made."—H. P. K.

dom from museum specimens. If in some of these cases the ventral-spined eggs only numbered, at a rough estimate, between ½ and 2 per thousand of the terminal-spined (in the case of a bladder stuffed with eggs they amounted to about 30 per cent.!), this does not alter the fact that they do occur in the bladder wall in company with the others. This new development does not, of course, annihilate the long-established rule that the vast majority of the eggs which appear in the urine are terminal-spined; its chief value only lies in that it shows the fallacy of the old belief as to an apparent difference in principle in the localization of the two forms of eggs.

Reviewing, then, the results of the observations here recorded, it is true that, in some minor details, they disprove the accuracy of my former statements; with regard to the essential points in the history of *S. hæmatobium*, however, they afford me no reason for modifying my views. So I hold, in accordance with the earlier observers, and until the contrary is positively proved, instead of being merely asserted on paper, that Egyptian bilharziosis, despite the various aspects it may present, is one entity, both pathologically and parasitologically: as the parasite is specifically the same in whatever organ it may occur, so there is no particular localization of the various forms of its eggs in the lesions produced.

In conclusion, I have to make some remarks about the "lateral spine" recently discovered in, and described as a normal character of, the eggs of *S. japonicum*, by Leiper (see *Transactions, Society of Tropical Medicine and Hygiene*, IV, No. 5, March, 1911). As the statement interested me very much, and the conclusions drawn from it did so even more, I tried to verify the fact; the material at my disposal consisting (1) of a portion of human liver permeated with enormous numbers of eggs; (2) a portion of cattle's liver almost equally rich in eggs; and (3) some entire female worms; all this (and other) material I owe to the kindness of Professor Fujinami, of Kyoto, Japan. That certain eggs practically possess the "spine" described by Leiper could be seen even in sections (stained and unstained) of the livers; but it was difficult, on the other hand, to positively establish its absence in cases where it was not visible. After various fruitless attempts, I succeeded in satisfactorily freeing the eggs from the surrounding tissue by macerating pieces of the livers for several days in 1/10 normal hydrochloric acid at temperatures between 55° and 60° C., shaking the preparations from time to time energetically and changing the fluid after sedimentation.* Transferred eventually into glycerine jelly the eggs showed the following conditions.

To begin with, the "spine" is not the only peculiarity noticeable in them. Very frequently, though not constantly, they have on one side a "calotte" of varying size, marked off from the rest of the shell by a distinct line; the calotte itself lying in some cases altogether in the normal curvature of the shell (fig. 8*a*, *b*), but often also rising above it in the shape of a cap (fig. 8*c*, *d*). In many of the macerated eggs, it had become (partly or entirely) detached after the fashion of a lid, to which indeed, save for its considerable variation in shape, size, and position, it bears a certain unmistakable resemblance. However, as it is not always perceptible, and I have not been able to examine fresh eggs for comparison, I refrain from giving any opinion about its nature, though it is not difficult to guess what this is. I have here mentioned its presence, because it is very helpful in finding the "spine" which, when present, always occupies the side opposite to the cap (fig. 8).

Now, as to the "spine," this is, according to my observations, not exactly a "normal" character in the eggs of *S. japonicum*. Among those which passed under my eyes, leaving aside all which had accidental folds or original malformations, about 25-30 per cent. showed not the slightest interruption of their even and smooth outer surface (fig. 8*e*). In the remaining 70-75 per cent. the "spine" was present and exhibited the following peculiarities: (1) It evidently does not consist of the substance of the shell, but of some other material applied to it externally, and probably forming a continuous, though extremely thin, coat all round the egg. While the shell proper is always of a distinctly yellowish colour, the "spine" is colourless and separated from the former by a sharp line of demarcation; the difference becoming more marked by the fact that, beneath the "spine," the shell proper is slightly thickened, the thickening projecting inwards with an irregular surface (fig. 9). As it persists, though not quite constantly, even in the eggs without "spine" it indicates the place of the latter in other eggs, and thus enables one to positively establish its absence. (2) The "spine," when present, varies with regard to its position on the shell. Its usual place is that shown in Leiper's pictures, but it may also occupy any intermediate position between the middle and one pole of the egg (compare fig. 8); pointing at the same time usually backwards, sometimes forwards, often sidewards (fig. 8*e*). (3) It varies with regard to its shape; being usually bluntly conical, sometimes cylindrical (thick or thin), with a sharply cut off end, and one or two tiny vacuoles inside, frequently needle-shaped, and either straight or bent, after the fashion of a hook or even that of a loop. (4) The most considerable variations occur in its size. I will here only state that the percentage of 70-75 above given includes, on the one hand, "spines" of the size figured by Leiper, and, on the other, "spines" just recognizable under high powers as minute shallow thickenings of the uncoloured substance (some of the more common variations are shown in fig. 9).

* The same method was also used for collecting the *S. hæmatobium* eggs from pieces of the bladder wall; as however, these eggs are somewhat more delicate, it is better to reduce the strength of the acid to ⅒ normal.

The examination of the adult females, owing to their somewhat distorted condition, did not yield very definite results. Only in one which contained in its uterus about sixty-nine eggs, separated by an empty interval into an anterior group of twenty-one and a posterior group of forty-eight, the "spine" could be seen distinctly in five eggs of the anterior group, but in only one of the posterior, although it ought to have appeared in more of these, had it been present to the same extent as among the eggs of the anterior group.

These being the results of my observations, I cannot see, in the first place, that the designation " spine " for the structure in question exactly tallies with what in ordinary language we call a " spine "; the less so as this " spine " does not even consist, as it actually does in the *S. hæmatobium* eggs, of the material of the shell proper, but of a special substance deposited on to it externally; corresponding in this respect altogether to the " spine " of some *Opisthorchis* and *Clonorchis* eggs, with which it also shares all the variations above described, including its total absence in a larger or smaller proportion of individual eggs. I am unable to see, in the second place, how the existence of this knob-like thickening of the shell envelope can possibly prove the specificness of the ventral spine, at the exclusion of the terminal, in the *S. hæmatobium* eggs. My recent investigations, in conjunction with those of earlier observers, render it quite obvious that this spine, whether terminal, or ventral, or intermediate, is one and the same formation, the variations in position, size, and shape depending on the factors above described. There is every probability that the analogous variations occurring in the knob of the *S. japonicum* eggs owe their origin to analogous circumstances; to straight away affirm the contrary may well serve a purpose, but remains a construction on paper so long as the assertion is not based on a single actual investigation of the conditions under which the *S. japonicum* eggs are formed.

## THE EPIDEMIOLOGY OF AMŒBIASIS IN THE SOUTHERN UNITED STATES, WITH SOME PERTINENT REMARKS AS TO THE ABSENCE OF LIVER ABSCESS IN THE SAME REGIONS.

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For some reason, not very well defined, the idea that the existence of amœbic dysentery in the Southern United States is rife has gained credence in the minds of students of tropical medicine. Accompanying this belief is another that the condition in this region is seldom or never attended with liver abscess—certainly not—as frequently as is the case in the Tropics of the Far East. That this impression is erroneous and lacking foundation will be attempted to be shown in this paper.

The Southern States of the United States, for the purposes of this discussion, will be considered: Georgia, Florida, Alabama, Mississippi, Arkansas, Louisiana, and Texas. The Carolinas, the Virginias, Maryland, Tennessee, and Kentucky—doubtless to be classed as Southern States within the strict meaning of the term—have been omitted for reasons of geographical and meteorological considerations. Brown [1], speaking of the epidemiology and geographical distribution of amœbic dysentery, says: " Most of the tropical states of North and South America are endemic centres of the disease; whilst in the temperate regions of both continents it is also extensively disseminated." He adds that in Florida and Texas it appears to be more prevalent than any other class of illness. Clemow [2], discussing the geographical distribution of liver abscess (a complication of amœbic dysentery), makes the following observation: " In the United States it is most often seen in the Southern States, but even as far north as Baltimore it is said to be *not very infrequent*." Osler, Brown and Clemow are English students. Strong [3], an American, writing of the etiology, distribution, and general prevalence of amœbiasis, mentions the southern portion of the United States as one of the regions where it is particularly observed.

At the outset it was the writer's intention to confine himself mainly to the endemiologic features of liver abscess as a sequela of amœbiasis in this particular section of the country, but the two subjects are so intimately associated it may be considered necessary or desirable to discuss both subjects in a general way and from the view point of their relation to each other. In order that a confusion of terms may not be found perplexing to the reader the writer will use the terms " amœbiasis " and " amœbic dysentery " interchangeably.

The United States Public Health and Marine Hospital Service [4] is presently engaged in conducting a series of investigations relative to amœbiasis. As a result of the labours of these active workers, up to the present time, the Service believes that the condition is much more common than was ordinarily thought. The preliminary report announces that in twenty-five States cases have been found. Surgeons Long and Austin, attached to this branch of the Governmental service, reported forty-eight cases from the United States Marine Hospital at San Francisco. This alone is in no wise convincing, that, because of the infectiveness of the Pacific Coast, the Southern United States are neccessarily high endemic centres. The majority of students of tropical medicine hold, as a general law, that the distribution, geographically, of liver abscess in tropical and sub-tropical regions is the same as that of amœbic dysentery. On account of the combative attitude of many students in this particular field of medicine respecting the etiological connection between amœbiasis and liver abscess there are many points which, perhaps, require elucidation. It is well known that amœbiasis and liver abscess curves do not everywhere and at all times maintain

a constant and definite relation to each other. For this apparent lack of parallelism many unique explanations are offered. It must not, however, be lost sight of that the area of pathologic distribution of certain parasites may be wider than the area of human morbidity for which they are responsible. By this is meant that the morbid process has a wider distribution potentially than actually. Any further discussion on this subject would be an encroachment on the domain of pathonomiatology for which the writer has no desire. The former racial and geographical anomalies of liver abscess are to-day easily explained by the difference in the mode of living, personal hygiene and environments, dietary and habits in the natives as compared with their white brothers of colonizing and civilizing fame.

Despite this, Scheube [5], Manson [6], and a host of other students of tropical medicine, particularly foreign (though some are Americans), call attention to the common occurrence of amœbic dysentery in the regions of the West Indies and the Southern United States, and at the same time make counter-observations to the relative rarity of liver abscess as a complication in the same territory.

The most convincing reason why liver abscess, generally speaking, does not exist in the above regions is the fact that amœbiasis is not prevalent except to a slight degree.

During the early part of 1911, I sent a number of communications to the principal hospitals, sanatoria, infirmaries, health officers, and leading physicians of the Southern United States, seeking information as to the occurrence of amœbic dysentery and other interesting phases thereof, principally that of liver abscess. The reason for seeking this information especially from institutional sources was the belief that the statistics obtained might bear the stamp of microscopical confirmation. In this belief, in a score of instances, I was rudely disappointed.

The replies received were of such a nature as to be positively convincing of the slight degree of prevalence of amœbiasis in this region. No attention whatever should be paid to the statistics and case reports appearing in the literature unless the diagnosis in each and every case is corroborated by careful microscopical study. In these regions, if amœbiasis did prevail, a diagnosis would lack substantiation because generally the medical man of the Southern United States does not use a microscope as a diagnostic adjuvant. Granting that the physician engaged in general practice does use a microscope, how many of them could differentiate between the *Entamœba histolytica* and the *E. coli*? This state of affairs is primarily due to the general practitioner, in the South, being engrossed in so many different medical problems that he has not sufficient time to give microscopy the attention it rightfully deserves. For the correct diagnosis of disease in the Southern United States, an examination of the fæces, in the great majority of cases, should be a routine procedure. This is absolutely necessary, as metazoan and protozoan parasites play a most important *rôle* in the pathological field of this section. This backwardness in medical research and diagnosis will be remedied probably only when the State Boards of Health have pathological and bacteriological laboratories situated at various accessible points throughout the respective States. Unfortunately, in the South, many problems of medicine—particularly tropical—of vast social and economic importance remained unsolved through lack of diagnostic aids and facilities. Opportunities and appliances for original pathological study should be supplied the practitioner in rural regions through the munificence of the State.

Some of the replies to my communications were interesting, and from the most important I will quote, beginning with the State of Texas.

### Texas.

Dr. W. T. Shell, Corsicana, asserts that amœbic dysentery does not prevail in his region.

Twelve cases of dysentery were reported from the Austin Sanitorium, Austin, of which two were said to be of amœbic origin. The *E. coli* was the parasite found in these two cases. The remaining ten cases were said to be bacillary in character.

Dr. L. H. Kirk, of the same city, and an attaché of the State Insane Asylum, says that he has observed only one case of what might be termed amœbic dysentery, and the organism he found was the *E. coli*.

A report from Dr. J. H. McLean, Attending Surgeon of All Saints' Hospital, Fort Worth, is worthy of comment. He reports four cases of dysentery, two bacillary, and two amœbic. One of the amœbic cases developed liver abscess from which the *E. coli* was obtained. The interesting feature of these reports is the suggestion what *rôle* does the *E. coli* play in the infected intestinal tract when we are taught that the *E. coli* is the harmless, and the *E. histolytica* the pathogenic, agent. Dysentery in which it is alleged that the *E. coli* are the causative factors is rendered uncertain by our knowledge of the non-pathogenicity of this type of amœba. The dysenteric condition in the foregoing series was probably due to some saprophytic organism and the finding of the *E. coli* was doubtless purely coincidental.

Dr. C. W. Trueheart, Health Officer of Galveston for the past ten years, makes several observations which, to my mind, are of decided importance. He says that dysentery of either the amœbic or bacillary type is very infrequent and that case reports are so extremely few in number that from a statistical standpoint they are of no value. As to the prevalence of amœbiasis or liver abscess in Texas there has been a dearth of literature concerning the condition since Dock [7] made his first observation exactly twenty years ago. At that time Dock reported twelve cases of both acute and chronic forms of this disease in and about Galveston. Judging from Dr. Trueheart's reply, the vicinity of Galveston

has undergone a great change since Dock's discovery.

### Alabama.

Replies concerning the existence of amœbiasis in Alabama were largely negative in character. It is interesting, however, to note that in this State no literature relative to amœbiasis or its complications of appreciable worth has appeared since Cunningham Wilson [8] reported a series of four cases in September, 1895, nearly sixteen years ago.

Two replies received from this State, one from Dr. W. M. Cunningham, of Corona, the other from Dr. P. T. Fleming, of Enterprise, are almost identical in character. Both of these observers have each seen over 100 cases of dysentery, all of which were bacillary.

Dr. W. C. Wheeler, Physician in Charge of the Madison County Hospital, Huntsville, asserts positively that amœbic dysentery does not exist in that region.

Dr. von Ezdorf, Surgeon-in-Chief of the United States Marine Hospital, situated at Mobile, in a personal communication, tells me that one of his colleagues, Dr. E. M. Feagan, of the same city, has in several cases of dysentery found the true pathogenic agents—namely, the *E. histolytica*.

Dr. Seale Harris, Mobile, before the 1911 Session of the American Society of Tropical Medicine, held in New Orleans, La., said that he did not believe amœbic dysentery to be very prevalent in the south. During his long experience he had seen only eighteen cases, all of which were widely scattered.

Dr. J. D. Davis, Birmingham, reported fifteen cases of amœbic dysentery, of which abscess figured as a complication three times.

### Florida.

The State of Florida, the southernmost of all the United States, furnishes the following information:—

Dr. R. H. McGinnis, Acting Assistant Surgeon of the United States Public Health and Marine Hospital Service, stationed at Jacksonville, states that since January, 1899, a period of over eleven years, 320 cases of illness have received treatment at the hands of the Service, and that not one case of liver abscess or amœbic dysentery appeared in the series.

Dr. J. L. Hodges, Gainesville, cannot recall having ever seen or treated a case of amœbic dysentery.

A most interesting report is that of the recent examination of 407 stools of the inmates of the Florida Insane Asylum [9] located at Chattahoochee. In this examination the *Necator americanus* was found 179 times, two cases of which were associated with round worms; the *Trichocephalus dispar* was found 26 times. Triple infection was present in three cases, the parasites concerned being the *N. americanus*, *Ascaris lumbricoides*, and the *T. trichiura*. It seems particularly significant that out of this number of examinations amœbæ were not once demonstrable.

Dr. G. R. Klock, Daytona, kindly called my attention to a case of pellagra complicated by amœbiasis.

Dr. J. L. Jelks [10], of Tennessee, was, I believe, the first to call attention to the association of pellagra with amœbiasis. This condition might offer a fruitful field for research.

### Mississippi.

Much to my surprise, the returns from the State of Mississippi showed a remarkable freedom from amœbiasis or its complications.

Dr. Jones, Physician in Charge of the Brookhaven Sanitorium, states that amœbic dysentery is unknown in that section.

Dr. W. O. Hubbard, who has been engaged in practice in and about West Point for the past fifteen years, is unable to recall a single case of amœbic dysentery.

The Delta, that portion of the State tributary to the Mississippi River, was, from the replies received, seemingly an uninfected region. This may strike one as exceedingly strange, inasmuch as Lafleur [11] called attention to the frequency of the disease in districts approaching the sea-levels, namely, the shores of the Gulf of Mexico and the Mississippi Valley.

### Georgia.

The prevalence of the disease in Georgia differed in no wise from the States already enumerated.

For instance, Dr. W. P. Rushin, Macon, had seen 37 cases of bacillary dysentery, and not one of the amœbic type.

The general tenor of the replies received indicated that amœbiasis or its complications were rare in this State. Literature relative to this condition in Georgia is very disappointing. There has been but scant attention paid to amœbiasis in the State.

The only observation of any note in many years has been that of H. F. Harris [12], who, in 1898, recorded a series of 35 cases, of which 32 occurred in Georgia, 2 in Tennessee, and 1 in Alabama. In the foregoing, liver abscess proved a complicated factor in 15 per cent. of the cases.

### Arkansas.

Dr. A. G. McGill, Little Rock, Arkansas, who as a member and also Chief of the Bacteriologic Division of the (Rockefeller) Hookworm Commission of that State, presents statistics of a conclusive and authentic nature which clearly prove the non-existence of amœbiasis in that State (Arkansas) as an endemic disease. Dr. McGill examined several thousand stools, and in that number dysenteric organisms were found only 20 times; of these 20 cases, 18 were of the bacillary and 2 of the amœbic type. The *E. histolytica* was the parasite found in the amœbic cases. Liver abscess followed one of the amœbic cases in which the pathogenic *histolytica* was found. Out of this vast number of cases the *Strongyloides intestinalis* was found once.

Drs. H. Pace, Eureka Springs, and W. C. Green, Little Rock, declare amœbic dysentery or its complications does not prevail in their respective sections.

Dr. H. N. Dickson, Paragould, and one of the busiest practitioners in that section, reports 9 cases of dysentery, of which 6 were bacillary and 3 of the amœbic type; out of the 3 amœbic cases the *histolytica* was demonstrable twice and the *coli* once. Liver abscess followed one of the amœbic cases in which the *coli* was the parasite found.

In view of the interesting report rendered by Dr. McGill of the Arkansas State Hookworm Commission it is hoped that the various Hookworm Commissions throughout the Southern United States in their forthcoming reports will give detailed findings of the fæcal examinations.

## Louisiana.

The State of Louisiana is deplorably backward in the matter of case reports and literature dealing with this condition. As to the prevalence of amœbiasis in this State we know but little. Dr. G. M. Stafford, Alexandria, has observed three cases of amœbic dysentery, in all of which he found the *E. histolytica*.

No record of any importance has crept into the literature save that of Simon [13], who, in 1909, reported a series of 50 cases, many of which were drawn from his hospital work. It was Simon's opinion that the disease was greatly prevalent, and that it was frequently unrecognized.

A month or so prior to Simon's observations Dock [14], the original investigator of amœbiasis in the South, in an address before the Orleans Parish Medical Society (May 10, 1909), called attention to the absence of this type of intestinal parasites in the vicinity of New Orleans, and said that as far as his investigations extended they were wholly negative as regards the city and surrounding country. The dissimilarity of the views of Simon and Dock, nearly synchronously, may appear exceedingly strange.

Dr. Thomas Dabney [14], New Orleans, reported three cases of true amœbic dysentery he had treated in a town called Gretna not far distant from New Orleans.

Dr. Marcus Couret, attached to the Department of Bacteriology and Pathology of Tulane University, and whose experience in this particular field of work is very extensive, in a personal interview said he really believes amœbic dysentery in these regions is undergoing a great diminution.

The Charity Hospital of New Orleans, an institution of 1,300 beds, having an average yearly admission of 10,000, between the years 1906 and 1910 inclusive, treated over 50,000 cases, and out of that immense number there were only 146 cases of dysentery of the amœbic type, in which liver abscess proved a complication 12 times, or less than 13 per cent. Of the above cases obtained from the Charity Hospital records, Simon, has included quite a number in his paper. In Simon's cases liver abscess followed in about 8 per cent. of the cases.

Many of the above hospital cases termed amœbic dysentery are diagnosed as such only clinically, and in not a few instances the diagnosis has failed of corroboration by a microscopical examination of the fæces; this in itself may bring the percentage of cases occurring in this region much lower. When one remembers that New Orleans is a large seaport city, holding daily concourse with the Tropics and other West Indian trading centres, and that the Charity Hospital situated there receives patients from the Panhandle of Texas to the Everglades of Florida, the number of cases of amœbic dysentery found in that region is very slight. Some observers believe that certain cases arising in New Orleans might be termed autocthonous.

From the foregoing facts it is almost absolutely established that the endemicity of amœbic dysentery in the Southern United States is extremely low. It is apparent that the non-occurrence of liver abscess is undoubtedly influenced by the infrequency of amœbiasis.

In order that I might not be accused of quoting only statistical data necessary for the maintenance of my views, I shall offer a brief review as to the prevalence of amœbiasis outside of the seven States to which I had originally intended to confine my discussion. Dr. Thomas B. Futcher [13], of Baltimore, at the 1909 session of the American Medical Association, said that up to 1903 the records of the Johns Hopkins Hospital had shown a series of 119 cases of amœbic dysentery, 95 of which cases originated in the State of Maryland. Liver abscess ensued in 22 of the 119 cases. Hobart Amory Hare [13], who was a participant in the same discussion, directed attention to the fact that at Jefferson Hospital (one of the largest in the country, with an annual admission of 5,400), located in Philadelphia, only 100 miles north of Baltimore, he had seen but 3 cases in eighteen years.

Wasdin [15] in 1891 reported one case from Charleston, South Carolina, which had its origin in Georgia.

Slaughter [16], 1895, reported a case from Virginia complicated with liver abscess.

Allen [13] in 1909 reported a small localized epidemic of amœbiasis in Charlotte, North Carolina. His conclusions as to the causative organism lacked absolute corroboration.

This, in brief, is the extent of the literature of any authenticity covering amœbiasis and which has been considered by some observers to be suggestive of the great prevalency of the malady.

Between the period of Councilman and Lafleur's [17] epochal discovery as to the pathogenicity and non-pathogenicity of certain types of amœbæ until its confirmation by Schaudinn [18] twelve years later, an etiological controversy, in which the real *rôle* of the amœba was contested from every viewpoint, was raised. Musgrave and Clegg [19], workers of no little repute, opposed the views of

Schaudinn, and in no uncertain terms expressed their reasons for not believing in the differentiation between the *histolytica* and the *coli*. Vedder [20], in a paper shortly after, showed that the criticisms of Musgrave and Clegg was not of stable foundation, and since that time Schaudinn's views have been nearly universally accepted. However, a dissenting few still regard the *E. coli* as much a pathogenic agent as the *E. histolytica*. To the present day there is also a lack of unanimity concerning the identifiable, morphological and cultural characteristics of certain amœbæ. Much of the literature which cropped out during this period bore the stamp of personal bias and partisanship, and thus lacked that substantiation and authenticity so necessary for the correct solution of medical problems.

### Liver Abscess.

Should amœbiasis in the near future become an extensively prevalent malady in the Southern United States, as is predicted by certain students of tropical medicine, it is a question, to my mind, whether liver abscess, to any degree, will ensue as a frequent complication. Within the last decade the Southern United States have undergone quite a social and political transformation in the way of temperance legislation. One may reasonably ask if the strict enforcement of statutory prohibition, thereby bringing about a decrease in the consumption of alcoholic beverages, might not exert an appreciable influence in the decrease of hepatic disorders, and thus lessen a grave predisposing factor.

From both an isochimenal and isotheral standpoint the Southern United States are nearly similar to that of the Tropical regions of the Far East, thus heat as a sole predisposing element would have to be excluded in the production of tropical abscess.

The etiology of liver abscess is embraced under three heads, namely (1) Predisposing; (2) Exciting or Relational; (3) Supplemental.

(1) Predisposing (a) alcoholism, (b) dietetic excesses, (c) exposure, (d) over-exertion and fatigue, (e) meteorologic conditions, (f) sexual excesses.
(2) Exciting or Relational—Amœbic dysentery.
(3) Supplemental (a) chronic hyperæmia of the liver, (b) morbid hepatic condition through past malarial or luetic infection, (c) intensification of the chronic hyperæmia by ague, severe illness or atmospheric vicissitudes, (d) traumatism.

While the third condition may be indirectly remote, it must be remembered that its absence would, in many cases, have prevented liver abscess.

The predisposition of the white soldier and the colonist, and the striking immunity of the native, to liver abscess cannot be explained by either racial influence or the belief as to a difference in the type of the amœbiasis by which they are both attacked. The native of the warm climates of the Far East, both by reason of religion and habits, shun alcohol; if he apes the civilization of his white brother and caretaker, his immunity from dysenteric disease or its complications is considerably lessened.

Kipling, the Anglo-Indian poet and author, and himself possessed of no small amount of pathological lore, summarizes fittingly in several of his "Barrack Room Ballads" the cause of many cases of tropical abscess in the soldier and governmental attaché serving in British India.

For instance in the "Young British Soldier," the poet, realizing the dangers that beset "Tommy Atkins," endeavours to advise him as regards the evils of drinking.

"When the 'arf made recruity goes out to the East,
'E acts like a babe an' 'e drinks like a beast,
'An' 'e wonders because 'e is frequent deceased
Ere 'e's fit for to serve as a soldier,
So-oldier *hof* the queen.

"First, mind you steer clear o' the grog-sellers' huts,
For they sell you fixed bay'nets that rots out your guts,
Ay, drink, that 'ud eat the live steel from your butts—
An' it's bad for the young British Soldier—
So-oldier *hof* the queen."

That the soldier's life of easy morals is responsible in many cases for his illness is made evident in the following verse from "Mandalay." The discharged "ten year sodger" voices his complaint of further residence in London very characteristically:—

"Ship me somewheres east of Suez, where the best is like the worst,
Where there aren't no Ten Commandments, an' a man can raise a thirst;
For the temple bells are callin', an' it's there that I would be—
By the ould Moulmein Pagoda, lookin' lazy at the sea—
On the road to Mandalay."

The mis-reckonings of the dangers of tropical life is best told in the experiences of a portly and plethoric member of Parliament, of an investigative turn of mind, who goes East to study conditions:—

"April began with the punkah, coolies, and prickly heat—
Paggett was dear to mosquitoes, sandflies found him a treat,
He grew speckled and lumpy—hammered, I grieve to say,
Aryan brothers who fanned him, in an illiberal way.

"May set in with a dust storm—Paggett went down with the sun,
All the delights of the season tickled him one by one,
*Imprimis*—ten days' 'liver'—due to his drinking beer;
Later, a dose of fever—slight, but he called it severe.

"Dysent'ry touched him in June, after the *Chota Bursat*—
Lowered his portly person—made him yearn to depart,
He didn't call me a 'Brahmin' or 'bloated' or 'over-paid,'
But seemed to think it a wonder any one stayed."

During the Boer War a cartoonist portrayed John Bull as civilizing and colonizing with a Bible, a gun and a bottle of rum, the first two of which were used for the submission of the native, while the latter was for John Bull's own destruction. After the American occupancy of tropical possessions, as a result of the Hispano-American conflict, the United States troops, unfortunately, failed to profit from the experiences of their English cousins, and medical literature emanating from the insular and

tropical countries under United States suzerainty was shortly filled with statistics dealing with amœbiasis and liver abscess.

Gastro-intestinal disorders in the Tropics primarily due to the eating of rich and savory foods, results in an increase in the consumption of alcohol there under the impression that it is a necessary aid to digestion. In point of fact nothing could be further from the truth.

A tropical climate is a sexual stimulant, and naturally leads to excesses. Life in the Tropics, where to a degree—varying, of course, man is deprived wholly or in large part of the moral environs so necessary for his well-being, is responsible in many cases for great debauchery and loose living.

Excessive smoking, perhaps largely on account of the cheapness of the best grades of tobacco and cigars, is a habit very often contracted in the Tropics by men who at home would eschew the weed. The result of excessive smoking is either a cardiac neurosis or a depressed heart.

The causes of the difference in frequency as to the prevalence of liver abscess as a *sequela* to amœbic dysentery in certain regions as contrasted with others are, therefore, readily apparent.

The theory of a difference in the type of dysentery or a difference in the type of the causative parasite being responsible for the absence of liver abscess in certain regions where amœbiasis is prevalent, is a false one. The *E. histolytica* of the New World is the same as that of the Old World; and, to the present time, within its known geographical limits, no morphological or cultural differences have been demonstrated in this type of amœba. The view that within certain geographical areas morphological or cultural differences might exist in the *E. histolytica*, was undoubtedly suggested by Stile's distinction in 1902, of the *Ankylostomum duodenale* of the Old World from the *N. americanus* of the New World.

It cannot be denied that amœbiasis does prevail in the Southern United States, but it is safe to say that its occurrence is rare. Most of the dysentery of this region is bacillary. Physicians practising in the rural districts of the Southern United States will recite their experiences with a type of dysentery frequently associated with malarial manifestations. This is a matter of too much importance to be disregarded. Craig [21], in his most interesting study of "Estivo-Autumnal Fevers," says:—"As a result of the localization of malarial parasites in the mucous membrane of the stomach and intestines, a true acute or chronic ulcerative enteritis and the formation of gastric ulcers may occur." Manson [6] and Deaderick [22] both call particular attention to malaria characterized by the appearance of dysenteric symptoms. How often this condition may be confounded with amœbiasis is only to be conjectured. The experience of physicians of the Southern United States with amœbiasis and liver abscess is practically nil.

The idea of a double dysenteric infection, that is, the combination of amœbiasis with bacillary dysentery, is a condition that rarely exists. Sandwith made special note of the infrequency of this double dysenteric infection in one of the recent Hunterian lectures.

The chief object in directing the attention to certain predisposing and supplemental causes of liver abscess in the Tropics was to dispel the impression created by certain students of tropical medicine, principally European, that amœbiasis minus its complication—hepatic abscess—existed in the Southern United States. The intimation by tropical authorities that amœbiasis is prevalent and that liver abscess is absent, without assigning any valid or definite reason for such argument, is absurd. As it is to-day, the Southern United States has manifold medical problems which prevent that section from progressing socially, politically and economically. If amœbiasis was present in these States, as is claimed, why is there such a dearth of literature relative to this important condition? Much of the literature that does exist is of no scientific or statistical value, for reasons heretofore given. Case reports are extremely rare, and the intervals at which they appear are long delayed.

While the endemicity of amœbiasis at the present time is low, we must recognize it in its proper light, and not disregard its importance as a future problem, but always be on the look-out for its spread. It is possible that time will show that I am rather in error as to the infrequency of amœbiasis in this part of the country, but I believe that in the main the conclusions I have drawn are correct. Certain opinions given herein differ in a marked degree from those held by acknowledged authorities. To the reader I would say the views and expressions not specifically attributed to other investigators are purely personal, and their confirmation or refutation will depend mainly upon the future labours of students in the field of tropical medicine. The frequency of amœbiasis and liver abscess will not be definitely and accurately known until the various Hookworm Commissions throughout the Southern States have made detailed reports of their findings, including the results of the stool examinations they are making daily.

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## REPORT OF A CASE OF BLACKWATER FEVER IN BRITISH NORTH BORNEO.

By H. J. McGREGOR, M.B., D.P.H.,
*Jesselton, British North Borneo.*

A MALE Eurasian, 24 years of age, was admitted to hospital at Jesselton, British North Borneo, on April 22, 1911. His temperature was 103° F., pulse 120. Patient very weak and feeble. Had been ill for three days with "fever," and as he did not improve was sent to hospital.

*History.*—Has been in Borneo since 1908 and has had repeated small attacks of malaria, and for the past few months has been taking quinine sulphate every day; for the past month, 5 gr. daily.

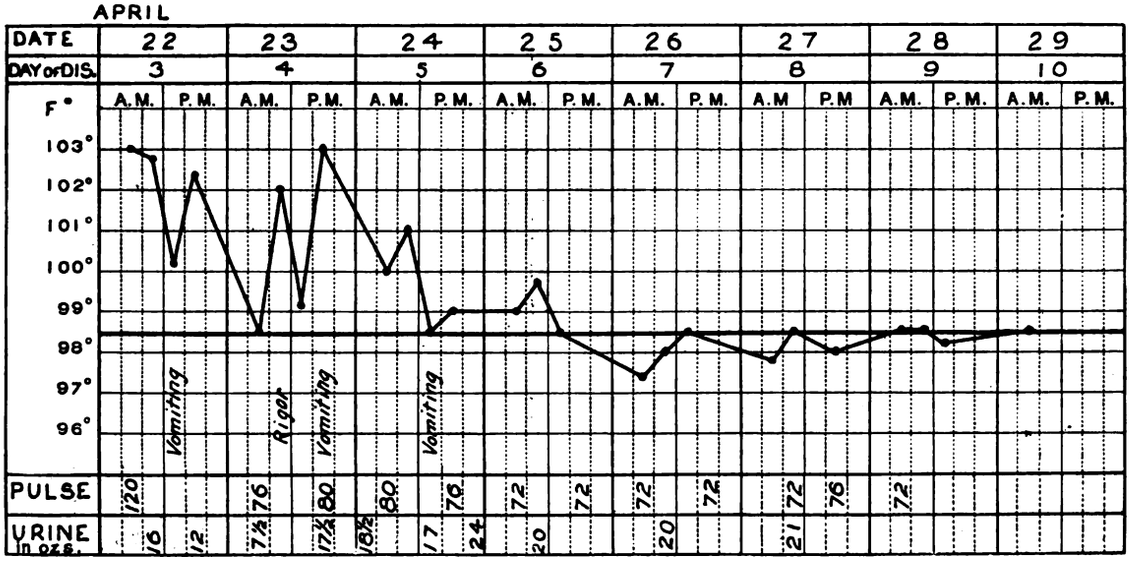
*State on Examination.*—On examination, the most noticeable feature was the colour of the conjunctivæ, which was a bright orange colour and the surface was glassy. The tongue was furred with a yellowish orange fur, and the skin showed the orange tint through the natural colour. The spleen was enlarged, and below the margin of the ribs, the liver showed no colour, with a heavy deposit; it contained albumen and had a specific gravity of 1015.

The principal complaint was of severe pain in back and head, persistent vomiting, and great thirst. He was given a purge of calomel, all quinine was stopped and a diuretic mixture given. No blood examination could be made, no microscope being available.

*Progress.*—On the 23rd the patient was much weaker, but quite clear in his mind. There had been incessant vomiting, great restlessness, and he sweated freely. Much less pain in back and head. The *conjunctivæ were fairly clear.* In the afternoon he had a severe rigor and the temperature, which had fallen to 98.6° at 8 a.m., rose to 103° at 8 p.m. Urine gradually changing to a "porter" colour.

On the 24th the vomiting was very severe. The *conjunctivæ were again a yellowish orange colour.* The urine dark, like "porter." He passed 59½ oz. of urine that day. At last the vomiting ceased, the temperature fell steadily, and normal at 4 p.m. Pulse and general condition began to improve from the same time.

On the 25th the conjunctivæ were normal in colour. No lumbar pain, no vomiting, and urine practically normal in colour. The temperature went up to 99.8° at mid-day, became normal at 4 p.m., and remained so. From this time the patient gradually picked up strength and was discharged on the 29th to proceed to sea for a change.




This is the first case of blackwater fever I have seen in this region, although several medical men here have spoken about the disease as occurring in Borneo. One interesting point is the clearing up of the orange tint from the conjunctivæ on the 23rd, and its reappearance on the 24th. Another that, in spite of all the general symptoms, the pulse remained fairly full and steady, being from 72-80 per minute after the day of admission. On being discharged from hospital, the urine contained much albumen, although its colour was normal and had been so for four days.

The chart shows the temperature curve.

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## DYSENTERY AND LIVER ABSCESS.

THE article in another part of this number by Dr. Howard D. King is interesting in many ways. It brings to light the prevailing uncertainty concerning not only the etiological relation of dysentery of any type to liver abscess, but also that even the connection between amœbiasis and liver abscess cannot be said to be settled. It has long been an axiom that although dysentery, frequently styled amœbic dysentery, occurs in the American Tropics, liver abscess is rare, and the conclusion therefrom is that the etiological connection between these two ailments is directly negatived.

This may or may not be true, but Dr. King, in his article, now tells us that bacillary and not amœbic dysentery is the prevalent type of the disease met with in the Southern States of the U.S.A., so that the legend that has so long obtained of the rarity of liver abscess following amœbic dysentery, at any rate in this part of the American Tropics, is apparently explained.

There are many matters which tend to delay the settlement of this question. There is, first of all, the clinical diagnosis between the different types of dysentery, namely, bacillary and amœbic. This is an apparently simple matter, easy enough when the subject is dealt with by experts in properly equipped laboratories, but for the general practitioner to make a statement one way or the other from a study of the signs and symptoms, merely makes the confusion worse confounded.

In all stools bacteria occur in health and disease, and in bacillary dysentery as well as in amœbic; finding bacteria of some kind in fæces is therefore not diagnostic of any ailment. The presence of amœbæ in the fæces is again a normal occurrence, but to diagnose between a harmless and a pathological amœba requires a trained bacteriologist to conduct the investigation. Any medical man unaccustomed to modern laboratory work has only to be shown the detail and intimate knowledge necessary to procure a perfect microscopic specimen of an amœba coli to understand the hopelessness of undertaking continued work of this kind whilst engaged in private practice. To be reliable, therefore, laboratories with efficiently trained bacteriologists are necessary adjuncts for an investigation of the kind, and Dr. King brings this matter prominently forward in his article. He advocates State-supported laboratories being widely established, for without these reliable work cannot be accomplished.

It is necessary that the private practitioner should be able to send his specimens for investigation to these laboratories as systematically as he uses his stethoscope, takes the temperature, and gauges the pulse, if exact conclusions in regard to types of dysentery are to be arrived at. This, of course, means money; for investigations of this kind require an "extra hand" to be paid, and the question, Who is to pay? has come to be a crucial point in the modern practice of medicine. For the doctor to pay for the investigation means either than he must practise his profession with increased expenses to himself, or he must raise his patients' fees. But the payment of the doctor ordinarily is looked upon by the public as an "extra" to be avoided at all hazards, as the "bad debts" of the doctors' books show; but when in addition a charge is added for the bacteriologist, the patient may, and often does, refuse to acknowledge the debt.

Doctors often say, given money and control they could gradually sweep away most of the diseases which afflict man; but if neither the money nor control is forthcoming, we must be content to proceed in the old way and to allow the ravages of disease to continue. When Gorgas was given money and power to fight the diseases of the Canal Zone, success was at once accomplished; and so in many departments of medicine could similar results be obtained were these conditions available.

The connection of liver abscess and dysentery is firmly believed in by many men; so firmly, indeed, that they will hear no evidence to the contrary. If the patient with a liver abscess says he never had dysentery, his statement may not be believed, and his questioner puts the patient down as a "perverter of the truth." If, on the other hand, the medical man who conducts the *post mortem* says that he could not find any trace of ulcer, scar, or inflammatory results in the intestine, he is apt to be regarded by the confirmed believer in the etiological connection between dysentery and liver abscess as an unreliable observer. Evidence, however, established by those who regard the patient as a liar and the doctor as a fool is not calculated to be scientific in its conclusions, and it is impossible to arrive at the truth in this way, for one can prove anything on these premises. That we are advancing in our knowledge of intestinal lesions and phenomena is undoubted; the progress, how-

ever, is slow but perhaps all the better that it is so. The intestinal tube, with its intricate chemical and bacteriological changes, is a difficult region of the body to tackle, and has proved itself to be so through all the ages. That we have got even a good start in the elucidation of intestinal ailments is doubtful, for we have not yet laid the foundations by which the investigation may be conducted. The first essential to success is ample laboratory equipment, and the question of the establishment of these is the question of the hour, not only in tropical but in all departments of medicine. If the State cannot see its way to increase these, then an attempt should be made to divert some proportion of the large sums of money being given to building colossal universities and medical colleges. The university is but the initial training ground, and a large portion of its usefulness is annulled if the students it sends forth cannot apply, for want of equipment, the teaching it has inculcated. To teach a man to ride is not much use to him if he is never subsequently able to get a horse; so the student, however well trained in the principles of bacteriology, will find his education mere waste, unless a laboratory is available whereby the knowledge he has acquired may be applied when he comes to practise his profession.

## Annotations.

*The Dangers of Salvarsan.*—Schamberg, in the *Journal of the American Medical Association*, May 20, 1911, discusses the causes of inflammation of cranial nerves after the use of salvarsan. The only disturbing results, Schamberg says, that have been reported after the use of salvarsan are occasional inflammations of cranial nerves, particularly of the optic and auditory nerves. Relative to the number of cases treated, however, such complications have been very small, though it is quite possible, as he states, that more of these may have occurred than have actually been recorded. Ehrlich denies any etiological relationship between the use of the drug and the development of the neuritis, regarding all such cases as fresh syphilitic neuritis; but others, Finger, for example, believed that though these complications are syphilitic, yet that they are related in some way or other to the administration of the salvarsan, perhaps because the drug seems to have a traumatic effect on the nerves. Schamberg believes that these inflammations have occurred exclusively after intramuscular and subcutaneous injections and not after the intravenous administration. Some cases have, however, occurred even after th intravenous route, though definite figures of the proportion of these are not yet to hand. The only way that accurate information will be able to be obtained on this very important subject is for all physicians immediately to report any cases or series of cases that have shown such inflammations, especially so in all such that have never had syphilis, but in whom the drug has been tried as a curative agent—for some other disease (malaria, trypanosomiasis, leukemia, &c.). Negative observations in this latter group should help very considerably in proving or disproving the truth of Ehrlich's contention.

Schamberg, after his careful and critical paper on the subject—which should be consulted in the original by those interested in the matter—concludes:—

(1) That inflammation of the optic, auditory, facial, and other cranial nerves has developed in a minute percentage of cases after the use of salvarsan in syphilis.

(2) That the same complications may occur spontaneously or after the use of mercury.

(3) That whether the incidence of such neuritic complications is larger after salvarsan than after mercury is a mooted question, on which foreign specialists are not agreed.

(4) That these inflammations have occurred almost exclusively in cases of recent syphilis.

(5) That they appear to have occurred exclusively after intra-muscular and subcutaneous injections, and not after the intravenous administration.

(6) That optic and auditory neuritis have in many instances cleared up under a second dose of salvarsan or under mercury and the iodides.

(7) That most of the cases of neuritis have occurred two to three months after a single injection of salvarsan. A risk therefore is incurred in discontinuing antisyphilitic treatment for a long period in early syphilis, after a single injection of salvarsan, particularly when given subcutaneously or intra-muscularly. It would be, of course, likewise dangerous to cease treatment after brief mercurial administration.

(8) That the intravenous method of treatment has many advantages over the treatment by other routes.

## Notes and News.

THE *Edinburgh Medical Journal* for June, 1911, is specially dedicated to the memory of the late Sir James Y. Simpson, one hundred years now having passed since the birth of that famous physician. Sir James was born at Bathgate, Linlithgowshire, on June 7, 1811, and died at Edinburgh on May 6, 1870. The part he played in giving chloroform to the world as an anæsthetic is known, of course, to all. Those who do not know the intimate history of the discovery and the experiments which led up to it will find all this detailed in the above number of the *Edinburgh Medical Journal*, where most interesting contributions are to be found from the pens of Sir Alexander Simpson, Sir Halliday Croom, Drs. Barber, Hart, Ballantyne, and Johnstone. A perusal of these will well repay anyone.

# Recent and Current Literature.

*A list of recent publications and articles bearing on tropical diseases is given below. To readers interested in any branch of tropical literature mentioned in these lists the Editors of the* JOURNAL OF TROPICAL MEDICINE AND HYGIENE *will be pleased, when possible, to send, on application, the medical journals in which the articles appear.*

### "The Lancet," May 27, 1911.

*Streptothrix Infection of the Pleura.*—A. Bernstein reports a case of what he believes to be a primary streptothrix infection of the pleura. The patient was a woman admitted to the Westminster Hospital, under Dr. Havilland Hall, for pleurisy. After several relapses of her pleurisy, fluid appeared on the affected side, and aspiration showed this to be pus. A portion of a rib was removed and the cavity was drained, much thick, foul-smelling pus escaping, and also a number of fibrous masses as large as hazel nuts. After this the patient eventually recovered, the wound healing up completely, and the temperature falling to normal. A pathological examination of the pus and fibrous masses removed at operation was made by Dr. R. G. Hebb, and the following conditions were found:—Sputum no tubercle bacilli, material from pleural sac exhibited a dense felt-work of filaments of streptothrix, the pus chiefly long filamentous chains. The organisms stained well by Gram's method, and very badly, if at all, by Loeffler's method. Cultures were all sterile till the seventeenth day, when a streptothrix in pure culture grew. The culture unfortunately soon died out, and apparently the chance of comparing it with others was lost.

### "The Archives of Internal Medicine." Vol. vii. No. 5. May 15, 1911.

*Oriental Sore.*—Darling describes a case of Oriental sore in a negro in Panama. The individual was born in British Guiana, and had lived in Trinidad, but had never been in the East at any time, nor had ever come specially in contact with coolies from India or other parts where these sores are endemic. It seems to have followed the bite of a fly. *Leishmania tropica* parasites were found in it. Darling does not think that the *Histoplasma capsulata*, which he recently described as causing a fatal disease in Panama, is closely related to the organism found in the Oriental sore described in his paper. It would seem, however, that the former parasite has affinities with the genus *Leishmania*, and it probably comes into that group.

### "The Australian Medical Gazette," April 20, 1911, Vol. xxx. No. 4.

*Spider Bites.*—Millard reports an interesting case of spider bite, closely corresponding in its symptoms to those produced by the bite of the red spotted spider (*Latrodectus hasselltii*). The patient was bitten on the back, and this was immediately followed by severe pain, which quickly ended in collapse. On admission to hospital three punctate marks in a vertical line about three inches apart were found over the right scapula. Morphia, strychnine, and fomentations were tried for treatment. The collapse lasted all day, being followed in the evening and at night by profuse sweating. Next day the pain subsided, but the patient still felt extremely weak. On the third day a sudaminal eruption appeared on the trunk and limbs. After this there were no further symptoms of importance. Convalescence gradually became established, and the man was discharged cured.

### "The British Medical Journal," June 3, 1911.

*Rat Trypanosomiasis.*—Minchin and J. D. Thomson, replying to a paper by Strickland on the mechanism of transmission of *T. lewisi* from rat to rat by the rat flea, do not agree with that author in his assertion that infection is normally brought about by rats eating infected fleas. From evidence which the two authors hope to publish in full detail later they believe that the normal method of transmission is, that the ripe, infective form of the trypanosome—the final form of the developmental cycle which it passes through in the flea—is regurgitated from the stomach of the flea into the wound made by the proboscis of the flea during the act of feeding.

This receives abundant support from other known cases of trypanosome infection. The devouring of the invertebrate host (the flea) by the vertebrate host (the rat) they believe is an exceptional occurrence without any bearing on the general problem of the transmission of trypanosomes.

### "The Transvaal Medical Journal." Vol. vi. No. 9. April, 1911.

*Scurvy.*—Hewetson writes on the Etiology of Scurvy, and Nightingale draws an etiological comparison and deduction between scurvy and beri-beri. In the Wankie Colliery Company, Hewetson states that scurvy has been responsible for many deaths, and he speaks of it as the *bête noir* of these parts. He enters into the various theories that have from time to time been advanced as the real cause of the disease, and proposes to deal further with the subject in the next issue of the Journal. Nightingale, who has seen beri-beri in the East, seems to think that scurvy is of a similar nature. For example, he believes that scurvy is due to a fungus growing on grain, probably the mealie, or that the disease is due to a fault in the milling of the grain, or to a combination of these two errors. Whether or not there is anything in this idea it is difficult to say. Certainly beri-beri is a totally distinctive disease from scurvy, and it does not seem likely that the latter should have an exactly similar cause to the former.

# Personal Notes.

### COLONIAL MEDICAL SERVICES.

*West African Medical Staff.*

*No deaths.*

*Resignation.*—J. H. Swan, L.R.C.S., L.R.C.P.Irel., Medical Officer, Gold Coast, resigns his appointment.

*No retirements.*

*No promotions.*

*New appointments.*—The following gentlemen have been selected for appointment to the Staff: K. B. Allan, M.B., B.S. Durham, Gold Coast; B. Knowles, M.B., Ch.B.Aberd. D.T.M.Liverpool, Gold Coast.

*Other Colonies and Protectorates.*

J. J. Hickey, M.B., B.Ch., B.A.O. (R.U.I.), T. D. Kennedy, M.B., Ch.B.Edin., J. R. McVail, M.B., Ch.B.Glas., D. A. Ogilvie, M.B., Ch.B.Edin., and J. Sharp, M.B., Ch.B.Glas., have been selected for appointment as Medical Officers with the work of House Surgeons in the Straits Settlements.

F. C. Morgan, M.R.C.S.Eng., L.R.C.P.Lond., has been selected for appointment as a Medical Officer with the work of a House Surgeon in the Federated Malay States.

C. J. Wilson, M.B., B.C.Cantab., M.R.C.S.Eng., L.R.C.P. Lond., has been selected for appointment as a Medical Officer in the East Africa Protectorate.

### INDIA OFFICE.

*Arrivals Reported in London.*—Major S. Anderson, I.M.S., B.; Major C. Donovan, I.M.S.; Lieutenant-Colonel P. J. Lumsden, I.M.S., B.; Major C. H. Bedford, I.M.S., B.; Major R. G. Turner, I.M.S., B.; Captain C. A. Gourlay, I.M.S., B.; Lieutenant-Colonel J. M. Cadell, I.M.S., B.; Captain J. Good, I.M.S., B.; Captain J. McPherson, I.M.S., B.; Colonel C. F. Willis, I.M.S.; Lieutenant-Colonel A. H. Nott,

I.M.S., B.; Captain J. F. James, I.M.S.; Captain F. P. Wernicke, I.M.S.; Captain V. N. Whitamore, I.M.S.; Captain W. H. Boalth, I.M.S.

*Extensions of Leave.*—Major C. E. Williams, I.M.S., B., 3 m.; Captain T. W. Harley, I.M.S., M., 10 days.

### List of Indian Military Officers on Leave.

*Showing the Name, Regiment, or Department, and the Period for which the Leave was granted.*

Anderson, Captain D. N., I.M.S., to July 24, 1911.
Baker, Captain D. G. R. S., I.M.S., 1 yr., from December 13, 1910.
Bensley, Lieutenant-Colonel C. N., I.M.S., 20 m., from March 12, 1910.
Blenkinsop, Major F. L., I.M.S., 19 m., from April 4, 1910.
Boalth, Captain W. H., I.M.S.
Bradfield, Captain E. W. C., I.M.S., 1 yr., from March 1, 1911.
Brierley, Captain W. E., I.M.S., 6 m., from March 7, 1911.
Burgess, Captain J. H., I.M.S., 15 m., from March 10, 1910.
Carter, Captain R. M., I.M.S., till July 26, 1912.
Croly, Captain R. G. G., I.M.S., 1 yr., from August 23, 1910.
Cunningham, Captain J., I.M.S., 19 m., from May 23, 1910.
Daly, Lieutenant-Colonel J. T., I.M.S., 18 m., from April 19, 1910.
Donovan, Major C., I.M.S., 8 m.
Fawcett, Captain F. O'D., I.M.S., 12 m., from December 2, 1910.
Fleming, Major A. N., I.M.S., 18 m., from May 19, 1910.
Gilbert, Lieutenant-Colonel C. E. L., I.M.S., 14 m., from September 24, 1910.
Graves, Major D. H., I.M.S., 1 yr., from March 28, 1911.
Greany, Lieutenant-Colonel H., I.M.S., 2 yr., from April 28, 1910.
Harris, Captain E. T., I.M.S., 8 m., from January 26, 1911.
Heron, Captain D., I.M.S., to June 9, 1912.
Holmes, Captain L. M., I.M.S., 12 m., from February 23, 1911.
Hynes, Captain G., I.S.M.D., 18 m., from April 16, 1910.
James, Captain J. F., I.M.S.
Kennedy, Captain R. S., I.M.S., 1 yr., from October 12, 1910.
Leonard, Captain W. H., I.M.S., 1 yr., from February 21, 1911.
Lister, Captain A. E. J., I.M.S., 8 m., from March 9, 1911.
Maconachie, Captain G. N., I.M.S., 1 yr., from July 15, 1910.
Maunsell, Captain E. C. C., I.M.S., 19 m., from February 23, 1910.
McGillivray, Captain W. S., I.M.S., 18 m., from March 21, 1910.
Millar, Captain G. M., I.M.S., 18 m., from June 1, 1910.
Moorhead, Major A., I.M.S., 1 yr., from November 28, 1910.
O'Hara, Colonel W., I.M.S., to June 6, 1911.
Pierpoint, Captain H. W., I.M.S., 1 yr., from January 9, 1911.
Reeves, Colonel T. C., I.M.S., 7 m. 10 d., from March 21, 1911.
Reinhold, Captain C. H., I.M.S., 1 yr., from November 15, 1910.
Reynolds, Captain L., I.M.S., 11 m., from December 12, 1910.
Roberts, Captain E. A., I.M.S., 15 m., from July 18, 1910.
Rodgers, Lieutenant-Colonel J. W., I.M.S., 4 m. 26 d., from February 8, 1911.
Sadler, Lieutenant A. W. W., I.S.M.D.
Shaw, Captain C. C. C., I.M.S., 17 m., from April 3, 1910.
Shettle, Captain F. B., I.M.S., 8 m., from March 23, 1911.
Thomas, Captain A. N., I.M.S., 8 m., from March 7, 1911.
Trafford, Captain W. L., I.M.S., 1 yr., from March 14, 1911.
Webb, Captain H. G. S., I.M.S., 15 m. 17 d., from April 22, 1910.
Wernicke, Captain F. P., I.M.S.
Whitamore, Captain V. N., I.M.S.
White, Lieutenant-Colonel W. W., I.M.S., 1 yr., from February 26, 1911.
Williams, Captain W. E. R., I.M.S., 1 yr., from March 15, 1911.
Willis, Colonel C. F., I.M.S., to November 8, 1911.
Wright, Captain W. D., I.M.S., 1 yr., from March 24, 1911.
Young, Captain G. J., I.M.S., 12 m., from February 10, 1911.

### List of Indian Civil Officers on Leave (including Military Officers under Civil Rules).

*Showing the Name, Province, and Department, and the Period for, and Date from, which the Leave was granted.*

Anderson, Major S., I.M.S., B., 15 m., December 7, 1910.
Anderson, Captain W. M., I.M.S., India, 24 m., April 3, 1910.
Bedford, Major C. H., I.M.S.
Beit, Captain F. V. O., I.M.S., Burma, 24 m., November 24, 1909.
Bose, Captain S., I.M.S., M., 21 m., November 1, 1909.
Brierley, Captain C. J., I.M.S.
Bryson, Major R., I.M.S., M., 24 m., October 8, 1910.
Burnett, Major S. H., I.M.S., Bo., 24 m., October 4, 1910.
Carter, Captain R. M., I.M.S., 5 m., October 27, 1910.
Chatterton, Major B. R., I.M.S., B., 7 m. 9 d., March 27, 1911.
Chaytor-White, Lieutenant-Colonel J., I.M.S., U.P., 18 m., March 26, 1910.
Clarkson, Lieutenant-Colonel F. C., I.M.S., B., Med. Dept., 24 m., March 1, 1910.
Clements, Captain J. E., I.M.S., 18 m., April 8, 1910.
Close, Lieutenant-Colonel J. K., I.M.S., U.P., 7 m. 7 d., November 9, 1910.
Cook, Captain L., I.M.S., B., 24 m., September 7, 1910.
Corry, Captain M., I.M.S., Punj., 21 m. 22 d., February 16, 1909.
Cragg, Captain F. W., I.M.S., M., 20 m., February 21, 1910.
Crawford, Lieutenant-Colonel D. G., I.M.S., B., 24 m., April 2, 1910.
Deas, Captain L. J. M., I.M.S., India Foreign, 15 m. 23 d., October 1, 1910.
Dimmock, Lieutenant-Colonel H. P., I.M.S., Bo., 6 m. 28 d., October 15, 1910.
Donovan, Major C., I.M.S., 8 m., December 16, 1910.
Drury, Lieutenant-Colonel F. J., I.M.S., Principal Med. Coll., Calcutta, 9 m., March 16, 1911.
Fisher, Major J. I.M.S., D.S.O., Rajpootana, 18 m., May 26, 1909.
Franklin, Captain G. D., I.M.S., India Foreign, 12 m., November 24, 1910.
Gabbett, Major P. C., I.M.S., M., 24 m., August 27, 1910.
Gidney, Major H. A. J., I.M.S., E.B. and Assam, 22 m. 24 d., December 9, 1909.
Gilbert, Captain L. E., I.M.S., Burma, 24 m., January 27, 1910.
Good, Captain J., I.M.S., Burma, 24 m., April 19, 1911.
Gourlay, Captain C. A., I.M.S., E.B. and A., 18 m., April 7, 1911.
Green, Major D. R., I.M.S., E.B. and A., 24 m., February 8, 1910.
Greig, Captain A. W., I.M.S., Burma Gaols, 24 m., May 3, 1910.
Greig, Major E. D. W., I.M.S., India Research, 8 m., April 1, 1911.
Harley, Captain T. W., I.M.S., M., 15 m., March 11, 1910.
Hefferman, Assist. Surg. W. St. M., I.S.M.D., Burma, 19 m., April 9, 1910.
Hooton, Major A., I.M.S., Bo., 21 m., February 6, 1910.
Houston, Captain W. M., I.M.S., 19 m., June 8, 1910.
Hudson, Lieutenant-Colonel C. T., I.M.S., Bo., 24 m., March 19, 1911.
Hudson, Lieutenant-Colonel E., I.M.S., U.P., 24 m., November 8, 1909.

## Notices to Correspondents.

1.—Manuscripts sent in cannot be returned.

2.—As our contributors are for the most part resident abroad, proofs will not be submitted to those dwelling outside the United Kingdom, unless specially desired and arranged for.

3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.

4.—Authors desiring reprints of their communications to the Journal of Tropical Medicine and Hygiene should communicate with the Publishers.

5.—Correspondents should look for replies under the heading "Answers to Correspondents."

# Original Communications.

## THE ÆSTIVO-AUTUMNAL PARASITE.

By Dr. H. M. JAMES.

*Ancon Hospital, Ancon, Canal Zone, Central America.*

IN the February number of the *Journal of Experimental Medicine*, New York (vol. xiii., p. 263) is an article by Dr. Mary Rowley-Lawson, on the Æstivo-Autumnal Parasite. In this article the author describes what she believes to be flagellating crescents in the peripheral blood, with an account of the manner of the flagellation, the subsequent impregnation of the female crescent by a flagellum, and consequent sporulation of the fertilized form. This process is described as occurring in its entirety in specimens taken from the peripheral blood, and one is led to believe that this third cycle of the parasite, with all the details as described, happens normally in man, and the resulting parasites are those which are responsible for relapses.

To ascertain the true cause of relapse in malaria, and to learn how to prevent it, has been for many years the object of not a few students of this disease in tropical countries. Only those who daily treat malaria, and who witness relapses in cases treated according to the best knowledge of the malady which is at present available, fully realize the importance of the solution of this problem. A very great percentage of the malaria on the Canal Zone is due to relapse and not to re-infection, and for this reason any information as to the genesis of relapses is of value to us, and to others who daily treat malaria in countries where this disease is both endemic and epidemic.

I failed to find in the author's paper any mention of control experiments with fresh blood. I cannot conceive that the changes in the gametes as described by her would be noted in stained specimens only, in so far as they refer to the formation and extrusion of flagella while the parasite is in the crescent stage. The same is true of the appearances described for the parasite while it is in the asexual form. Had control experiments with fresh blood been made, and if the author had been familiar with the work of Marchiafava and Bignami on the position of the parasites with reference to the erythrocytes, the error of assuming the organisms to be extra-corpuscular could not have been made. To make deductions from stained specimens only when it is possible to control the appearances under consideration with fresh blood observations, is to argue from very insufficient premises, to say the least. I wish, however, to bring before you what seem to me to be fundamental errors which make her deductions of no value whatsoever. This latter is to be regretted, for the coloured plate at the end of her article contains beautifully delineated and remarkably accurate representations of certain phases in the life-history of the crescents, and it is unfortunate indeed that to these representations cannot be attributed their proper interpretation, as the illustrations are the best I have hitherto seen.

The author begins her paper with a description of the male and female forms of the crescents. She interprets the staining reactions of these in a manner directly the reverse of what is true. It is the male crescent or microgametocyte and not the female or macrogamete, whose cytoplasm takes on a light hue after the use of one of the modifications of the Romanowski stain. The author describes the macrogamete as staining a light blue and the microgametocyte as taking on a darker blue colour. The error of this assumption is obvious to anyone who is at all familiar with the staining reactions of crescents. Very frequently the cytoplasm of the microgametocyte does not take the stain at all, and this is true not only of the crescents, but also of the male gametes of tertian and quartan malaria. In fact, among the protozoa in general, the microgamete, since it is destined for future reproduction, contains a relatively abundant supply of cytoplasm, which reacts, in proportion to its amount, to the basic part of the polychrome stain, while the microgametocyte, which supplies chromatic material only, is relatively poor in cytoplasm, and for the most part takes a hyaline appearance after the use of the stain.

Following this fundamental error, the author goes on to describe a process of flagellation in the supposed microgametocytes, which in reality are macrogametes. This process is described as occurring in the peripheral blood, prior to its withdrawal from the body.

In this respect it is to be regretted that the author did not give details as to the manner of obtaining the specimens. I shall endeavour to make my statement clear. The so-called flagellation is not a process of flagellation at all, but a description of the reduction of the chromatin of the macrogamete. In Plate XXIX., figs. 1 to 10, inclusive, are interpreted by the author as various degrees of flagellation in the microgametocyte, and as occurring in the peripheral blood before withdrawal, the supposition being that the specimen dried too rapidly for the representation to be otherwise. In reality the figures represent *moist chamber* preparations of female crescents. The appearances as described for the parasites immediately after withdrawal are wholly inaccurate, and never take place if the blood is dried at once. However, if preparations are exposed to dampness, either accidentally or in a moist chamber, the process, as described, begins immediately, but it occurs, as I have said, in female crescents and not in males. The so-called flagella are not true flagella, but are forms taken by the chromatin during reduction. The true flagella are very different in appearance, and had the author been familiar with their appearance, she would not have confused them. I make these assertions confidently, as I have done a great deal of work recently and in the past, on moist chamber preparations of crescents, and I am entirely familiar with the appearance of the male and female forms from the time they leave the peripheral blood, both in fresh and in stained preparations, until flagellation and reduction have been completed.

There is no doubt whatever that the forms described by the author are not to be found, as she infers, in the usual preparations, but are to be obtained only

in moist chamber preparations or after the slides have been exposed to dampness, accidentally or intentionally. Reduction in both male and female forms takes place very rapidly after exposure to air or dampness, and the so-called flagellate appearances occur after exposure of one minute in a moist chamber, or if, in the presence of atmospheric dampness, the slide does not dry immediately.

Similarly, in Plate XXIX, figs. 12-23 are all reduction stages of the macrogamete. I think you will agree with me that the author has not made the proper differentiation in the delineation of the male and female crescents. Figures 24 and 25, which are supposed to represent microgametocytes after flagellation, are nothing more than macrogametes, whether before or after reduction I cannot say, as the details are not sufficiently clear, but probably the latter.

The whole description of this so-called flagellation displays remarkable unfamiliarity with a knowledge of the morphology not only of æstivo-autumnal parasites, but of other species as well. One can attribute to inexperience the careful and laborious account of reduction in the macrogamete as a process of flagellation in the microgametocyte, but it is not so easy to understand how the author could have described as occurring in the peripheral blood the forms that appear only after exposure to dampness, or in a moist chamber.

Much of the description of the asexual cycle is on a par with that of the process of flagellation. The "loop" attachment, by which the parasite is supposed to maintain its perilous position on the outside of the erythrocyte, is nothing more than a fixation of one of the amœboid shapes of the organism. If the parasite is observed in the fresh blood, especially if the patient has taken quinine, the "loop" will be seen to withdraw into the body of the plasmodium, and to have an entirely different significance from that attributed to it by the author.

The "bar" forms are very common in fresh blood specimens from cinchonized patients, and their interpretation as a proof that the parasite is extracorpuscular is only one of the many mistakes made in the article.

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## THE ETIOLOGY OF BLACKWATER FEVER.

By G. J. Pirie, M.B., Ch.B., D.P.H.(Aberd.), W.A.M.S.

In these days, when there is still great doubt as to the true etiology of blackwater fever, I may be pardoned for sending these few notes on the peculiar similarity of the conditions that led up to attacks of hæmoglobinuria in four cases of blackwater, which I have had under treatment during six years on the West Coast of Africa.

*Case* 1.—(S.), employed on the Gold Coast. This European had been several years in India, and had suffered from malaria there. Subsequently he came to West Africa, where he had repeated attacks of malarial fever. He said he had not been able to take quinine, as even a few grains (one or two) were sufficient to cause his urine to turn red. One afternoon he visited some friends some miles away, and while there he felt ill, and was persuaded to take three grains of quinine, by the mouth. He returned about 7 p.m. and came up to the hospital; while still feeling ill he sat down to have some dinner, and had just finished his soup when he felt very chilly, and soon after had a rigor. Blood films were taken, and in them were found a few subtertian malarial parasites. Owing to his definite statement about quinine no more quinine was given. He was put to bed about 8.30 p.m., and about 12 midnight his urine first showed signs of hæmoglobinuria. This increased till about 4 a.m. when the urine was dark port wine colour. After that the urine began to clear, and by 4 p.m. in the afternoon of the next day it was again clear. He informed me that he had had several attacks just such as this, and all after taking small doses of quinine for what he called "fever."

*Case* 2.—(B.), an engine-driver. This European was doing his second tour on the Coast. He had had an attack of blackwater, from which he had recovered. He was still in hospital when I saw him, and his urine had then been clear for three days. While still in hospital and about a week after I arrived, he complained of headache and sickness. His temperature had risen and blood films were taken and stained by Leishman's stain and examined. Large numbers of subtertian rings were found. Owing to his just having recovered from blackwater, he was not at first given quinine. His temperature, however, continued to rise, and when it got to 104·6° F. and was still rising, I decided that, in the presence of the parasites, quinine must be given. Accordingly nine grains quinine bihydrochloride were given intramuscularly about 4 p.m. About 11 p.m. he passed some hæmoglobinuric urine. This increased till the urine was dark red, and then the urine began to clear. Twenty-four hours after the onset of the hæmoglobinuria his urine was clear. His convalescence after this was uninterrupted. This European had come from a highly malarial station, and he told me he had had repeated attacks of "fever" there.

*Case* 3.—A railway foreman. This man had been some years in South Africa. He had been one year in West Africa, and had been very careless with himself, and had especially neglected his quinine. He was admitted to hospital about 11 a.m. with a temperature of 103° F. and on blood films being taken and examined enormous numbers of subtertian parasites were found. Practically every infected red cell had two rings. The patient was in a very collapsed condition, and nine grains of quinine were given intramuscularly. His temperature during the afternoon continued to rise, and at 5 p.m. was, in spite of all treatment, 105·8° F. At that time another intramuscular of nine grains of quinine was given. Profuse perspiration started at 7.30 p.m., and by 1 a.m. his temperature was just over normal. During the second twenty-four hours of his illness he was given about forty grains of quinine by the mouth. During the forenoon of the third day his urine became hæmoglobinuric. This never got greater than to cause the urine to be dark red, and in twelve hours passed off and his urine became normal. There

was a slight rise of temperature with the hæmoglobinuria.

*Case* 4.—A sergeant. He complained of headache and had a slight rise of temperature to 101° F. Blood films showed a few subtertian rings. He was given during the first day of illness 20 gr. of quinine bisulphate by the mouth, and his temperature came down to normal in the evening. During the second day he again took altogether 20 gr. of quinine, and at 8 p.m. passed some hæmoglobinuric urine. His urine rapidly darkened till almost black, and his temperature during the hæmoglobinuria rose to about 102° F. The quinine was stopped when the hæmoglobinuria began. The urine continued dark port wine colour and at times almost black till the afternoon of the third day, when it began to clear, and was normal two days later. Two days after that it was attempted to give the patient a tonic in the form of iron and arsenic compound (B. W. and Co.). These contain each 2½ gr. quinine. One 'tabloid' was given in the forenoon, and at 1 p.m. there was distinct hæmoglobinuria. No more 'tabloids' were given, and in four hours the urine began to clear. His urine remained clear since. The four-hourly chart of this case is interesting, as it shows during the continuance of the hæmoglobinuria a daily rise of temperature, beginning in the forenoon and continuing all day and falling during the night, the typical appearance of a malarial temperature.

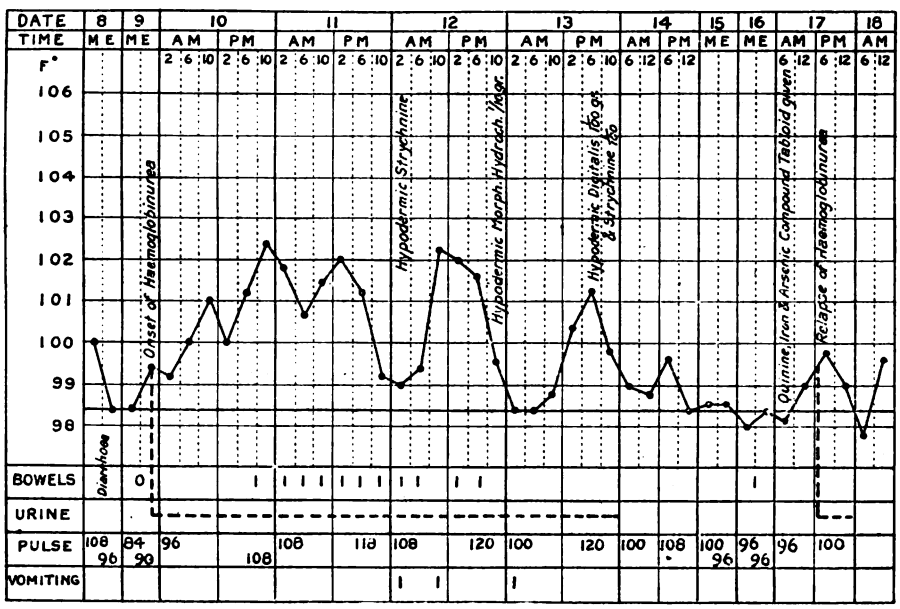


CHART OF CASE IV.

Showing the daily rise of temperature during the hæmoglobinuria and the relapse of the hæmoglobinuria after the iron and arsenic and quinine 'tabloid.'

In all these cases no malarial parasites, though carefully looked for, were found after the onset of the hæmoglobinuria.

The interesting points in these cases are :—

(1) The finding in each case of subtertian rings in the peripheral blood of the patients, before the onset of the hæmoglobinuria.

(2) In each case quinine was taken or given in order to treat the malaria, also before the hæmoglobinuria.

(3) In case (4) the recurrence of the hæmoglobinuria when a small dose of quinine (2½ gr.) was given in the iron and arsenic compound 'tabloid.' (See chart of case 4.)

(4) The typical malarial temperature chart of case (4) during the continuance of the hæmoglobinuria. There were no malarial parasites at this time in this patient's peripheral blood, but it looks almost certain that sporulation was taking place in some of the internal organs.

Each of these patients had the appearance of having been well saturated with malarial poisoning. The first and third case had not taken, or had taken quinine very irregularly. Number two had not used his mosquito net and had most probably (though he said the contrary) taken his quinine irregularly. Case (4) had taken 5 gr. quinine daily. All these cases developed blackwater more or less severely. Fortunately, however, blackwater does not occur in every case, where there has been a history of repeated attacks of malaria, which have been treated with quinine. It would be absurd to dogmatise on the results of merely four cases, but it appears to me to be more than a mere coincidence, that in each of these cases the onset of the hæmoglobinuria should have followed the attempt to treat an attack of malarial subtertian fever with quinine.

I think that only those persons whose resistance to the hæmolytic action of the malaria parasite has been reduced by the continuous sporulation of the parasite in their system are susceptible, and that in those persons a dose of quinine may be the actual exciting cause. This condition of susceptibility is induced by neglect of, or irregularity in the taking of the daily dose of 5 gr. of quinine. In cases where one has been assured that 5 gr. of quinine have been taken regularly every day, it may be that certain types of constitution are so peculiarly susceptible to malarial infection that the 5 gr. of quinine daily are not sufficient to prevent the continuous sporulation of the parasite in the system, though that dose may be sufficient to prevent any illness or great discomfort sufficient to make the patient take to bed. These persons get anæmic and debilitated, and gradually develop that unstable condition of the red blood corpuscles that may ultimately end in an attack of blackwater fever.

In the majority of Europeans on the West Coast of Africa 5 gr. of quinine per day are sufficient to prevent any great danger from malaria, and I believe

that the prevention of malaria is the prevention of blackwater fever.

For prevention of malaria 5 gr. of quinine a day is the maximum dose one can expect any European to take without great risk of dyspepsia and its subsequent debility.

Any European in whom 5 gr. of quinine daily is insufficient to prevent the continuous sporulation of malarial parasites is a person unsuitable for life on the West Coast, and it cannot be too strongly urged that once a European has had blackwater, however slightly, he should not again return to West Africa.

I must apologize for having taken up so much space over these few cases. I trust, however, that others with similar or dissimilar experiences of blackwater will come forward and describe them.

The chart shows the daily rise of temperature during the hæmoglobinuria, and the relapse of the hæmoglobinuria after the iron, arsenic and quinine tabloid.

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## FURTHER RESEARCHES ON THE DEVELOPMENT OF *TRYPANOSOMA GAMBIENSE* IN *GLOSSINA PALPALIS*.*

By Colonel Sir David Bruce, C.B., F.R.S., A.M.S.; Captains A. E. Hamerton, D.S.O., and H. R. Bateman, R.A.M.C.; and Captain F. P. Mackie, I.M.S. (Sleeping Sickness Commission of the Royal Society, Uganda, 1908-10).

The object of these experiments was to try to discover if there is any definite cycle of development of the trypanosome of sleeping sickness in the tsetse fly, *Glossina palpalis*, and if the late or renewed infectivity of the fly coincides with any phase in this development.

The mode of experimentation was to feed a cage-full of *laboratory-bred* tsetse flies on an animal whose blood contained numerous trypanosomes, and at the end of various times to kill the flies and examine their intestinal contents. This was done for periods of one day, two days, three days, and so on, up to 56 days. The microscopical examination of preparations made from the intestinal contents on the various days gave information as to the number and appearance of the trypanosomes.

After the infective feed or feeds the flies were fed every day on a healthy animal, so that by the appearance of trypanosomes in the animal's blood the day on which one or more of the flies became infective could be arrived at.

### Method used in the Examination of the Flies.

The flies were killed by exposing them to the vapour of chloroform. After being killed the proboscis and pharynx were removed and examined under a cover-glass with the high and low powers. The terminal segment of the abdomen of the fly was then snipped off, and the whole abdominal viscera gently pressed out. This was moistened with a little normal saline solution, and the gut unravelled without rupturing. The proventriculus and crop were often pulled out intact with the gut. The whole thoracic and abdominal tract could then be laid out in line and examined under a low power.

In taking out the gut it was generally possible to draw out with it the abdominal portion of the salivary glands, which could then be separated without contamination from accidental rupture of the gut. If the salivary glands or proventriculus remained behind they were dissected out after removal of the gut. In every case these organs were thoroughly washed in three changes of normal saline solution, in order to minimize the chance of their being contaminated by accidental rupture of the intestines.

The stained specimens were examined day after day, and coloured drawings, at a magnification of 2,000 diameters, made of all the different forms met with. The drawings of the trypanosomes found in the proboscis, proventriculus, fore-gut, mid-gut, hind-gut, proctodæum, and salivary glands, were kept separate, so that a series of drawings of trypanosomes taken from any one part, from the first day of infection to the 56th day, could be compared.

By arranging these drawings on a wall the horizontal layers would represent the contents of, say, the fore-gut from one day onwards, while the vertical rows would represent the trypanosomes found in the whole length of a fly for one day. More than six hundred drawings were made in this way, so that it seems impossible that any important form can have been left out.

### General Considerations regarding the Development of the Trypanosomes in the Fly.

Let us now take a general view of the types of trypanosomes found in the various parts. It is evident that very few of the six hundred drawings can be reproduced; a few types, taken here and there, must suffice. For the first three or four days trypanosomes are found in all the flies, but at the end of six or seven the trypanosomes have disappeared out of many of them. That is to say, it is only in a certain percentage that further development takes place. In one series this was 8 per cent. In 92 per cent., then, of flies which imbibe infected blood, the trypanosomes simply degenerate and die out within the first few days. In 8 per cent., on the other hand, the trypanosomes find conditions more favourable for development, and increase to a marvellous extent, filling the whole of the fore-gut, mid-gut, and hind-gut with countless swarms of trypanosomes.

How long this development continues is unknown. It is considered probable that it continues for the remainder of the fly's life, and this has been proved by experiment up to 96 days.

What the conditions in the intestine of the fly are, which render this development possible, are also unknown. It was thought that it might depend on the reaction of the intestinal fluids. This is, however, found on examination to be faintly acid in all flies, whether development has taken place or not. The presence of bacteria also seems to have

* A Communication read before the Royal Society on March 16, 1911.

TABLE I.—NUMBER OF TRYPANOSOMES FOUND IN THE VARIOUS PARTS OF THE ALIMENTARY CANAL AND SALIVARY GLANDS.

| Time, days | Proboscis | Proventriculus | Crop | General smear of gut | Fore-gut | Mid-gut | Hind-gut | Proctodæum | Salivary glands |
|---|---|---|---|---|---|---|---|---|---|
| 1 | – | – | | | | + + | | | – |
| 1 | – | – | | | | + | + | | – |
| 2 | – | | | | + | + | + + | | – |
| 3 | – | | | | | + + | + + | | |
| 4 | – | | | | + | + | + | – | – |
| 5 | – | – | – | | – | – | – | | – |
| 6 | – | – | – | + | + | + | | | – |
| 7 | – | – | – | + | | | | | – |
| 8 | – | + | | | + | + + | + + | | – |
| 8 | – | | | | ± | ± | ± | | |
| 9 | – | – | | | ± | + + | | – | – |
| 9 | – | | | | + | + | + | | |
| 10 | – | | | | + | + + | + + | | |
| 10 | – | | | | | + | | | |
| 11 | – | ± | – | + + | – | ± | ± | | – |
| 11 | – | ± | – | + + | + + | ± | | | – |
| 11 | – | + + | | | + + | + + | + + | | – |
| 14 | – | + + + | – | | + + | + + | | – | – |
| 14 | – | + + | – | | + + | + + | + + | | – |
| 15 | – | – | | | + | + | | | – |
| 17 | – | – | – | | ± | + + | + + | | – |
| 17 | – | + + | | – | + + | + + | | | – |
| 18 | – | – | | | + + | + | + + | | – |
| 18 | – | | | | | + + | + + | | – |
| 20 | – | + + | | | + + | + + | + + | ± | – |
| 21 | – | | | + + + | | | | | |
| 22 | – | | | + + | | | | | |
| 23 | – | | | | + | + | + | | |
| 24 | – | | | | + + + | + + + | + + + | | |
| 25 | – | – | – | | + | + + + | + + | | + |
| 28 | – | | | + + | | + + | | | + |
| 30 | – | + | | | + + | + + | | | + |
| 30 | – | + | | | + + | + + | ± | | – |
| 31 | – | + | + | | + + + | + + | | | – |
| 31 | – | | | + | | | | | |
| 34 | – | | | + + | + + | + + + | + + + | – | – |
| 35 | – | – | | | + | + + | + + | | – |
| 36 | – | | | + + + | + + + | + + + | + | | + |
| 36 | – | – | | + + + | + + | + + + | | | – |
| 36 | – | + + | | + + + | | | | | |
| 37 | – | | | + + | | | | | |
| 40 | – | | | + + | | | | | |
| 40 | – | | | + + | | | | | |
| 42 | – | + + | | + | + + | | | | + |
| 43 | – | | | + + | | | | | + + |
| 44 | – | + | | | + + | + + + | | | + |
| 44 | – | | | | + | + + | + + | | + |
| 44 | – | + | | | + | + | + | | + |
| 46 | – | + | | | + + + | + + + | + + + | | + + |
| 49 | – | – | – | | + | ± | | | – |
| 51 | – | | – | | + | + | + + | | – |
| 53 | – | – | | | ± | ± | | | – |
| 53 | – | – | | | + | + + | | | + |
| 53 | – | | – | | | ± | | | – |
| 56 | – | | | + + | | | | | + |

no connection with the phenomenon. Sex, moreover, has no influence; development occurs in as many males as females.

### TYPES OF TRYPANOSOMA GAMBIENSE FOUND IN THE ALIMENTARY CANAL.

It would serve no good purpose to describe separately, day by day, the types found in the various parts of the alimentary canal, as they run into each other in such a way that any classification of them seems impossible.

The following table represents, approximately, the numbers found in the different parts of the alimentary canal at various times after infection. The — sign means that an examination was made and nothing found. ± means few. +, many. + +, very many. + + +, swarming. If no sign, then no examination has been made.

*The Proboscis.*—In our experience *Trypanosoma gambiense* is never found in the proboscis of *Glossina palpalis*, except immediately after an infected feed, when for a short time blood containing trypanosomes may be seen in the lumen of the proboscis. This is very different from what obtains

in an infection by *Trypanosoma vivax*, in which case the proboscis is alone infected.

*Proventriculus.*—As seen from the above table, this part of the alimentary canal is sometimes found empty when the remainder of the gut is swarming.

*Fore-, Mid-, and Hind-gut.*—It is here that the greatest development of the trypanosomes is found. Among the extraordinary numbers and diversity of type it is difficult or impossible to find one's way. Generally speaking, the trypanosomes found during the first few days are merely degenerating blood forms. After this there appears a type of trypanosome which remains dominant throughout the whole developmental period. This is a long, moderately broad form, the protoplasm staining well, without granules or vacuoles, having an oval compact nucleus situated in the centre of the body, a small round micronucleus lying at some distance from the elongated snout-like posterior extremity, the undulating membrane narrow and simple, and the flagellum proceeding little, if anything, beyond the protoplasm of the cell. The flagellum also appears very frequently to arise from a pink-coloured body, situated near the micronucleus, an appearance never seen in the normal blood trypanosomes.

This seems to be the healthy normal developing type in the intestine of the fly. It is seen in all parts of the intestine and at all times. It forms masses of innumerable individuals alike in size and shape. When a fresh supply of blood is taken in by the fly this type can be imagined to multiply with extraordinary rapidity. When the blood supply runs low then this type can also be imagined as degenerating and disappearing just as rapidly. The host of diverse forms which thus arises beggars description. Some are round or oval in shape, 3 or 4 microns in diameter, with or without a flagellum. From this simple form all shapes and sizes can be seen up to the huge shapeless mass of protoplasm, multinucleated and multi-flagellated.

In our experience, the long narrow forms, described by some observers as "male" forms, are exceedingly rare, and it seems impossible to ascribe to them any very important *rôle* in the process of development. Crithidia-like forms are also exceedingly rare—that is, forms with the micronucleus close to or anterior to the nucleus.

Types of *Trypanosoma gambiense* found in the Salivary Glands.—On referring to Table I. it will be seen that trypanosomes did not appear in these glands until the twenty-fifth day, but that after this time they were usually present. In our opinion, this invasion of the salivary glands is of the greatest importance in the history of the development of *Trypanosoma gambiense* in *Glossina palpalis*. Here it may be parenthetically remarked that, because one kind of development takes place with one species of trypanosome and one species of tsetse fly, it by no means follows that the same thing will occur either with another species of trypanosome or another species of fly. Each combination must be worked out separately and nothing left to analogy. *Trypanosoma vivax* and *Glossina palpalis* afford a striking example of this.

In the development of *Trypanosoma gambiense* in *Glossina palpalis* one circumstance, which we think of prime importance, emerges, and that is, that in the salivary glands, and here alone, the trypanosomes are found to revert to the normal blood-type. It must not be imagined, however, that the salivary glands show no other forms but this blood-type. On the contrary, there are many other forms seen; but here only are found trypanosomes apparently identical with the short and stumpy forms found in the blood. What causes or leads up to this reversion to the blood-type in the salivary glands is quite unknown, but, as will be seen later, the *Glossina palpalis* does not become infective by biting until this invasion of the salivary glands takes place.

How the trypanosomes find their way into the salivary glands is also quite unknown. It seems highly improbable that they pass from the alimentary canal by way of the salivary duct, and as they are never found in the body-cavity, it is also difficult to see how they can make their way directly from the intestine to the abdominal portion of the salivary glands.

### Infectivity of Trypanosoma gambiense after its Development in Glossina palpalis, as shown by the Bites of the Flies giving rise to the Disease in Healthy Animals.

As has been shown in a previous paper,* the fly ceases to be infective by biting within a short time of its infective feed. From this time on for some twenty-eight days the fly remains non-infective.

The following table illustrates this:—

Table II.—The Result of the Bites of Flies at varying periods after an Infective Feed.

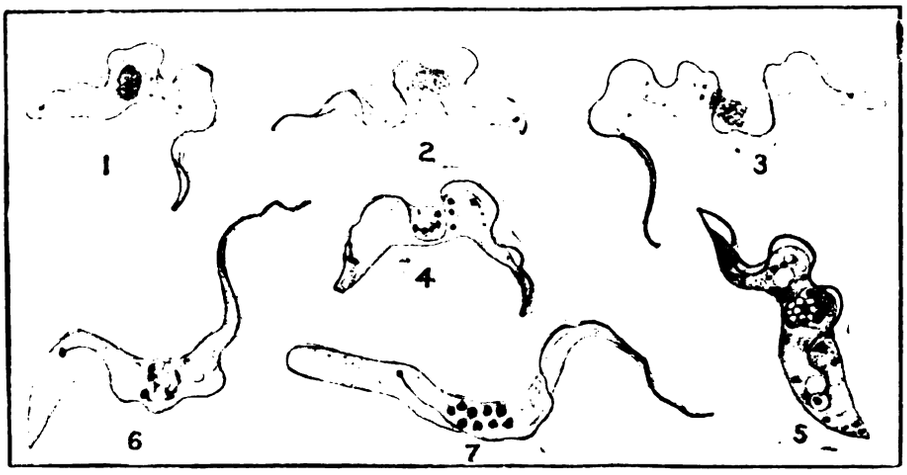
| No. of days after infective feed | Result of bites | No. of days after infective feed | Result of bites |
|---|---|---|---|
| 1 | – | 28 | + |
| 2 | – | 30 | – |
| 3 | – | 31 | – |
| 4 | – | 34 | + |
| 5 | – | 35 | – |
| 6 | – | 36 | – |
| 8 | – | 37 | + |
| 9 | – | 40 | + |
| 11 | – | 40 | + |
| 14 | – | 42 | + |
| 15 | – | 43 | + |
| 17 | – | 44 | + |
| 18 | – | 46 | + |
| 20 | – | 51 | – |
| 23 | – | 53 | + |
| 25 | – | 56 | + |

From this table it will be seen that in this series of experiments the flies first became infective twenty-eight days after the infective feed, and that after this time the flies are usually found to be capable of giving rise to the disease by their bites.

It was stated above that the most important dis-

* *Royal Society Proceedings*, B, 1911, vol. 82, p. 498.

ILLUSTRATIONS OF VARIOUS MODIFICATIONS IN THE SHAPE OF *TRYPANOSOMA GAMBIENSE* IN *GLOSSINA PALPALIS*.

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FIGS. 1 to 3.—Normal blood parasites (*T. gambiense*).
FIG. 4.—24 hours after ingestion by the fly.
FIGS. 5 and 6.—48 hours after ingestion by the fly.
FIG. 7.—96 hours after ingestion by the fly.

Figs. 1 to 7 represent the trypanosomes as they appear in the intestine of *G. palpalis* during the first few days. Figs. 1 to 3 are ordinary blood forms, as seen immediately after the fly has fed, and before any change has taken place. Figs. 4 to 7 represent the process of degeneration which takes place during the first four days. The body swells up, the nucleus breaks up, and the cytoplasm becomes vacuolated.

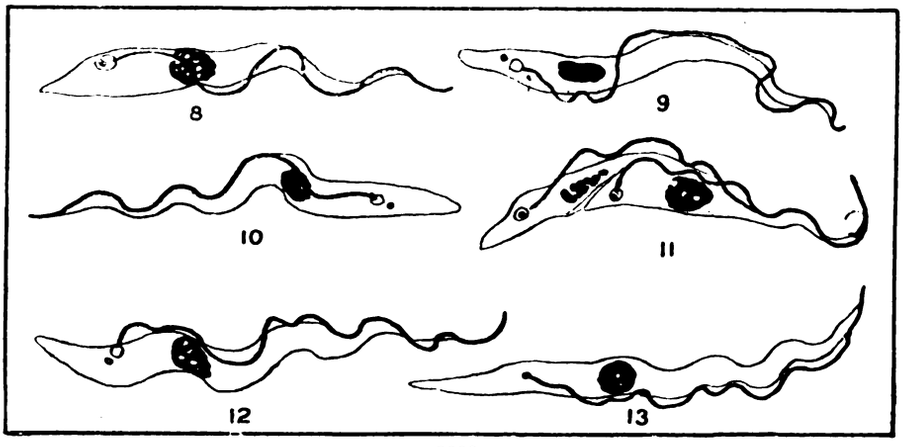


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FIG. 8.—*T. gambiense* from fore-gut, 8 days after infected feed.
FIG. 9.—*T. gambiense* from proventriculus, 14 days after infected feed.
FIG. 10.—*T. gambiense* from fore-gut, 18 days after infected feed.
FIG. 11.—*T. gambiense* from mid-gut, 25 days after infected feed.
FIG. 12.—*T. gambiense* from mid-gut, 34 days after infected feed.
FIG. 13.—*T. gambiense* from fore-gut, 44 days after infected feed.

Figs. 8 to 13 represent what we consider to be the normal reproductive or developing type found throughout the intestine during the whole period of development. It is to be noted that this form is longer and broader than the normal broad form; the protoplasm is clear, and stains readily and evenly, and this cell looks normal. The nucleus is compact and situated nearer the posterior extremity than the anterior. The micronucleus is small and round, lying at some distance from the elongated posterior extremity. Many dividing forms of this type can be seen. In our opinion, this is the common multiplying form, and from it arises an infinite variety of degenerating forms.

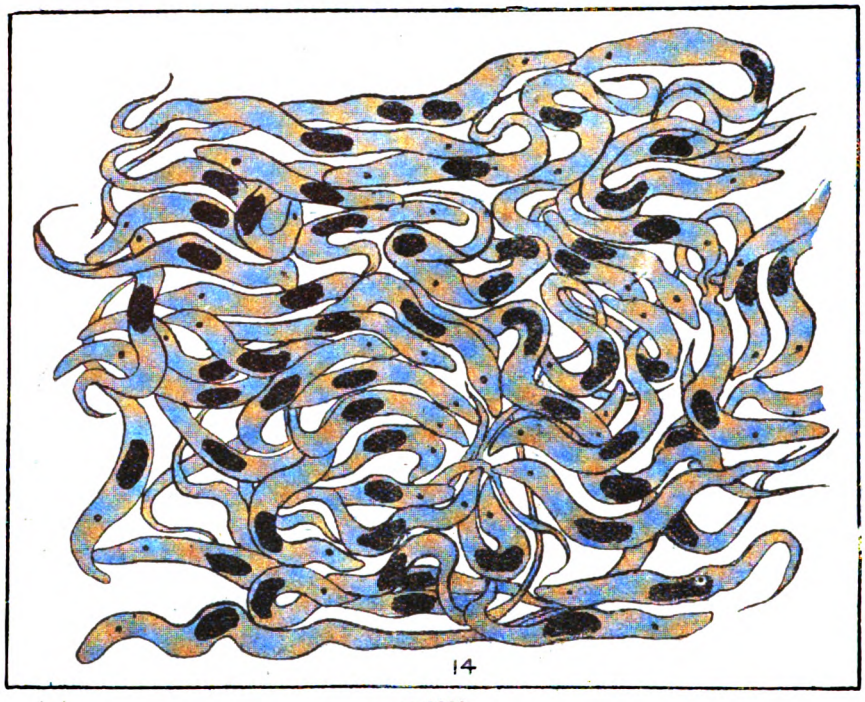


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FIG. 14.—Part of a mass of *T. gambiense* from the mid-gut.

This figure is given in order to try to convey some idea of the enormous proliferation of trypanosomes which takes place in the intestine of *G. palpalis*. Throughout the whole length of the alimentary canal, from the proventriculus to the proctodæum, this condition is frequently seen, and in the living condition presents an extraordinary spectacle. Looked at through the wall of the intestine the matted masses are seen in active movement, swaying about and wriggling in every direction. They do not appear to be attached to the wall of the intestine, but move about freely, and when the intestinal wall is burst pour out in countless numbers. The trypanosomes evidently belong to the type figured in the preceding sketch, called the normal reproductive type.

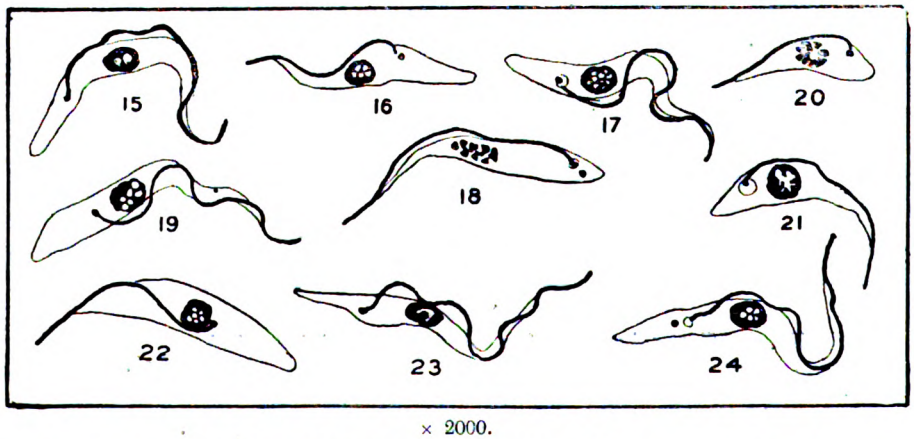


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FIG. 15.—*T. gambiense* from hind-gut, 8 days after infected feed.
FIGS. 16, 17, and 18.—*T. gambiense* from mid-gut, 14, 20, and 30 days after infected feed.
FIG. 19.—*T. gambiense* from hind-gut, 34 days after infected feed.
FIGS. 20 and 21.—*T. gambiense* from proventriculus, 36 days after infected feed.
FIG. 22.—*T. gambiense* from hind-gut, 44 days after infected feed.
FIGS. 23 and 24.—*T. gambiense* from mid gut, 46 and 53 days after infected feed.

Figs. 15 to 24 represent smaller forms which are fairly common and occur throughout the intestine and at all times. The examples given above are taken from the eighth day to the fifty-third day. They are called by us "small developmental forms," since they resemble the larger in having clear protoplasm and a compact nucleus. Dividing forms are often seen.

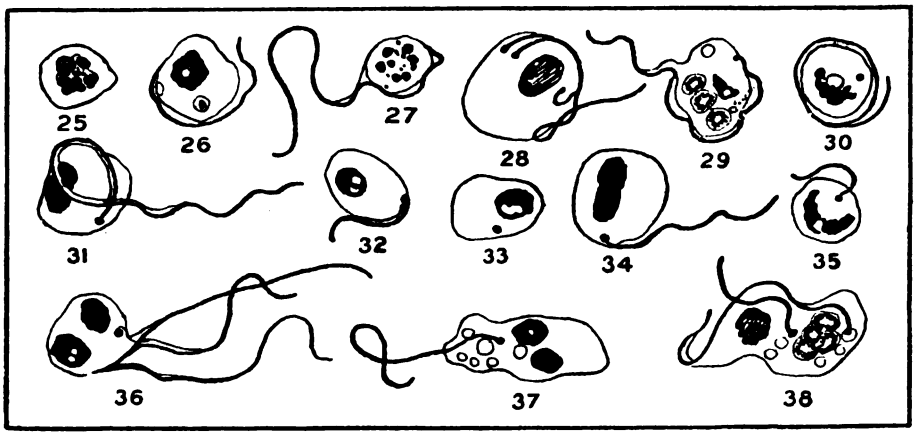


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FIG. 25.—*T. gambiense* from mid-gut, 8 days after infected feed.
FIG. 26.—*T. gambiense* from fore-gut, 11 days after infected feed.
FIGS. 27 and 28.—*T. gambiense* from mid gut, 16 and 17 days after infected feed.
FIGS. 29, 30 and 31.—*T. gambiense* from fore-gut, 17 and 18 days after infected feed.
FIG. 32.—*T. gambiense* from hind-gut, 20 days after infected feed.
FIGS. 33 and 34.—*T. gambiense* from fore-gut, 24 days after infected feed.
FIGS. 35, 36, and 37.—*T. gambiense* from mid-gut, 24, 44, and 46 days after infected feed.
FIG. 38.—*T. gambiense* from fore-gut, 46 days after infected feed.

Figs. 25 to 38 represent round and irregularly-shaped forms of the parasite taken from the eighth to the forty-sixth day of development. It is impossible to say what is exactly the origin of these forms—whether by the segmentation of large masses, or simply by the division and subdivision of irregular forms. Some of the examples figured are evidently dividing, as they show several nuclei and flagella. Whether the round aflagellar forms correspond to the so-called "latent" forms of various writers it is impossible to say. Those possessing flagella were active during life. In our opinion, they may be looked upon as part of the degenerative processes which are constantly taking place in the intestine of the fly.

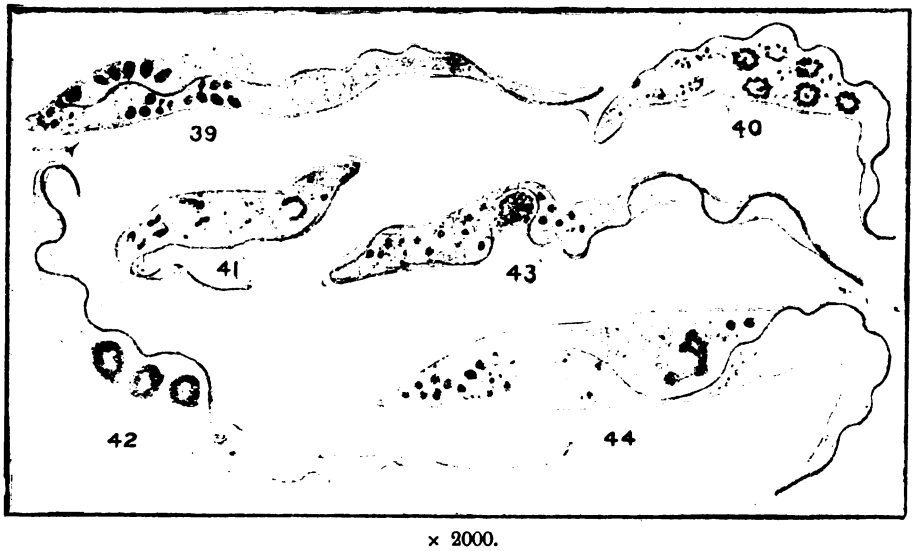


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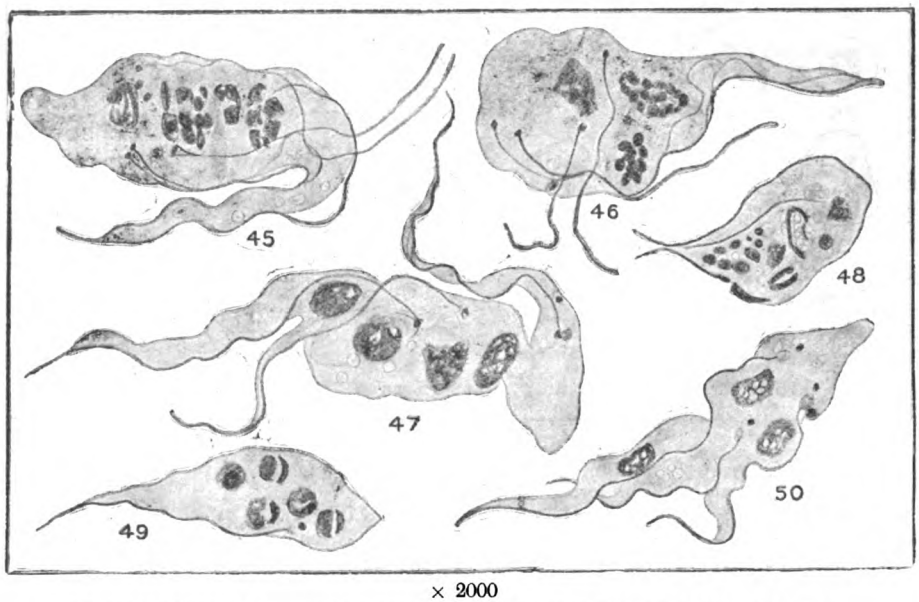
FIG. 39.—*T. gambiense* from hind-gut, 10 days after infected feed.
FIG. 40.—*T. gambiense* from fore-gut, 17 days after infected feed.
FIG. 41.—*T. gambiense* from fore-gut, 17 days after infected feed.
FIG. 42.—*T. gambiense* from hind-gut, 34 days after infected feed.
FIG. 43.—*T. gambiense* from mid-gut, 34 days after infected feed.
FIG. 44.—*T. gambiense* from hind-gut, 46 days after infected feed.

Figs. 39 to 44 represent what appear to us to be degenerative forms of the "normal reproductive type." They are of all sizes and shapes, and the cell-contents are scattered over with broken-up nuclei, or at least granules of some stainable substance. Figs. 39, 43, and 44 are also vacuolated.

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FIGS. 45, 46, and 47.—*T. gambiense* from hind-gut, 10 days after infected feed.
FIG. 48.—*T. gambiense* from fore-gut, 17 days after infected feed.
FIG. 49.—*T. gambiense* from proventriculus, 30 days after infected feed.
FIG. 50.—*T. gambiense* from mid-gut, 46 days after infected feed.

Figs. 45 to 50 represent some of the more exaggerated types of degenerative forms. As will be seen from the drawings, they are huge, mis-shaped masses of protoplasm, multinucleated and, as a rule, multiflagellated.

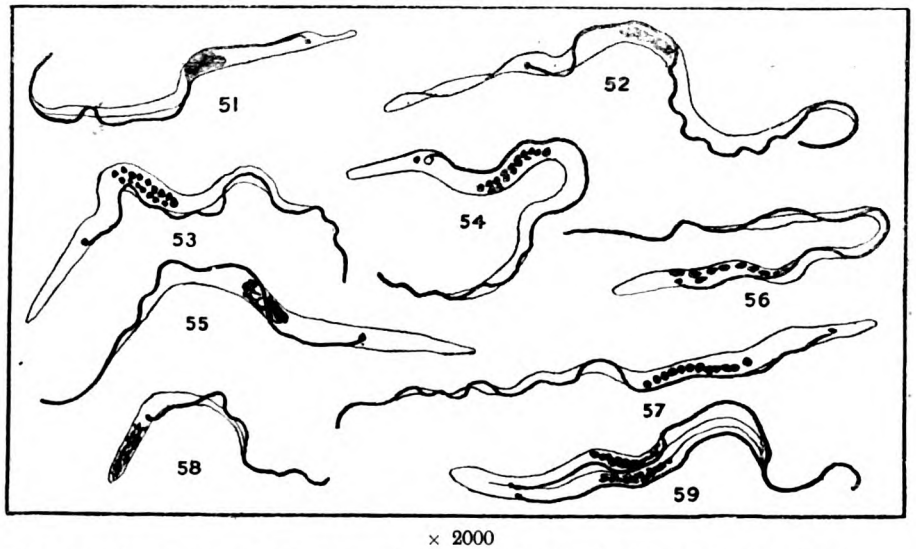


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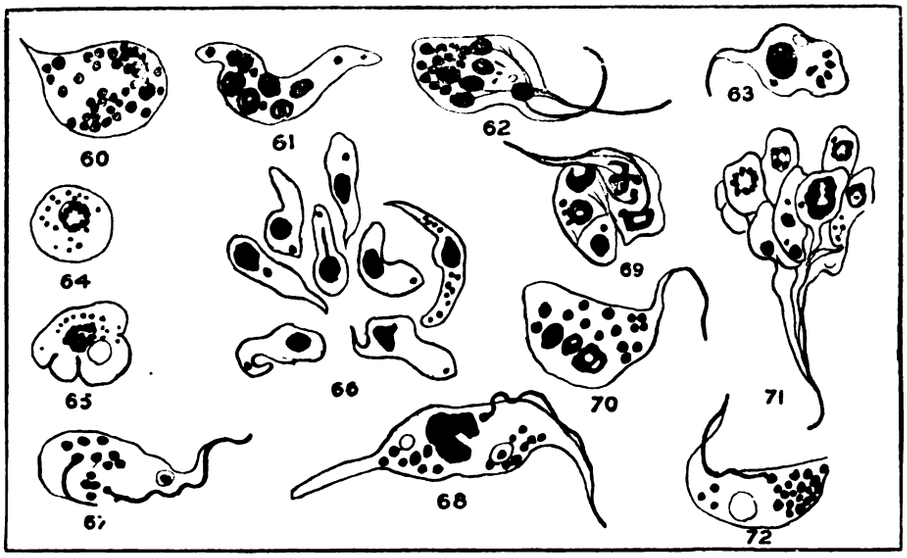
FIG. 51.—Slender type of *T. gambiense* from proventriculus, 17 days after infected feed.
FIG. 52.—Slender type of *T. gambiense* from mid-gut, 17 days after infected feed.
FIG. 53.—Slender type of *T. gambiense* from hind-gut, 20 days after infected feed.
FIGS. 54 and 55.—Slender types of *T. gambiense* from fore-gut, 24 and 30 days after infected feed.
FIGS. 56 and 57.—Slender types of *T. gambiense* from proventriculus, 44 days after infected feed.
FIGS. 58 and 59.—Slender types of *T. gambiense* from fore-gut, 46 days after infected feed.

Figs. 51—59 represent various varieties of the slender type of *T. gambiense* found in the intestine of *G. palpalis*. Fig. 59 is dividing. Fig. 58 is a Crithidia type. These slender and crithidial types are uncommon, and no special connection between them and the onset of infectivity in the fly has been made out.

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FIGS. 60 and 61.—*T. gambiense* from salivary glands, 25 days after infected feed.
FIG. 62.—*T. gambiense* from salivary glands, 30 days after infected feed.
FIG. 63.—*T. gambiense* from salivary glands, 42 days after infected feed.
FIGS. 64, 65 and 66.—*T. gambiense* from salivary glands, 44 days after infected feed.
FIGS. 67 and 68.—*T. gambiense* from salivary glands, 46 days after infected feed.
FIGS. 69 and 70.—*T. gambiense* from salivary glands, 53 days after infected feed.
FIGS. 71 and 72.—*T. gambiense* from salivary glands, 56 days after infected feed.

Figs. 60 to 72 represent aberrant forms of *T. gambiense* seen in the salivary glands. The first thing to be noted is the fact that the trypanosomes do not appear in the salivary glands until a late date; in this case the earliest appearance is 25 days after the infected feed. How they reach these glands is up to the present unknown. In what shape they reach the glands is also unknown. Figs. 64, 65, 69 and 71 might be said to point to some process of segmentation, of which the finished product is represented by fig. 66.

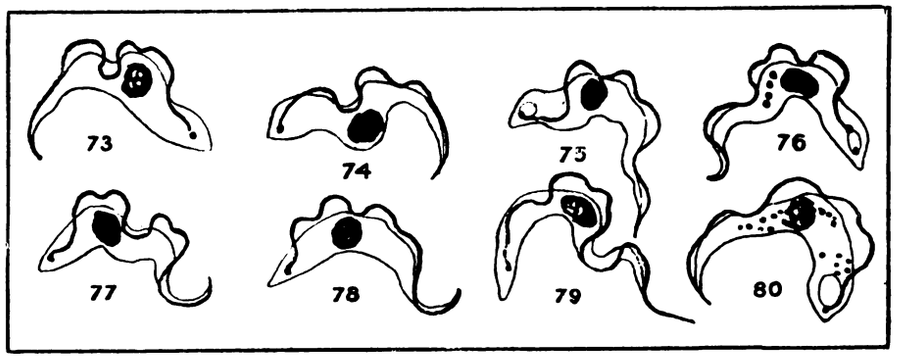


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FIG. 73.—*T. gambiense* from salivary glands, 34 days after infected feed.
FIG. 74.—*T. gambiense* from salivary glands, 42 days after infected feed.
FIG. 75.—*T. gambiense* from salivary glands, 43 days after infected feed.
FIGS. 76, 77, and 78.—*T. gambiense* from salivary glands, 46 days after infected feed.
FIGS. 79 and 80.—*T. gambiense*, from salivary glands, 56 days after infected feed.

When alluding, generally, in a previous part of this paper to the types of *T. gambiense* found in the salivary glands, it was said that in the salivary glands, and here alone, the trypanosomes are found to revert to the normal type found in the blood. Figs. 73 to 80 illustrate this reversion. By comparing them with figs. 1, 2, and 3, which represent normal blood trypanosomes, it will be seen that they are very similar to the short and stumpy form found in the blood. No such forms have ever been seen in any other part of the fly, and we would suggest that the occurrence of these forms in the salivary glands, coinciding as it does with the renewed infectivity of the fly, is more than a mere coincidence.

covery made in this research is the connection between the invasion of the salivary glands and the infectivity of the fly. That this appears to be so is shown in the following table:—

TABLE III.—TO SHOW CORRELATION BETWEEN THE INVASION OF THE SALIVARY GLANDS OF GLOSSINA PALPALIS BY TRYPANOSOMA GAMBIENSE AND INFECTION BY THE BITE OF THE FLY.

| Experiment No. | No. of days after infective feed | Bites of flies infective or non-infective | Salivary glands | Remarks |
|---|---|---|---|---|
| 1910 | 1 | – | – | |
| 1910 | 2 | – | – | |
| 1910 | 3 | – | – | |
| 1910 | 4 | – | – | |
| 1910 | 5 | – | – | |
| 1910 | 6 | – | – | |
| 1910 | 7 | – | – | |
| 1894 | 8 | – | – | |
| 1894 | 9 | – | – | |
| 2216 | 10 | – | – | |
| 1894 | 11 | – | – | |
| 1871 | 14 | – | – | |
| 1693 | 15 | – | – | |
| 1945 | 17 | – | – | |
| 1945 | 18 | – | – | |
| 1945 | 20 | – | – | |
| 1718 | 25 | – | + | Blood-type not present |
| 1602 | 28 | + | + | Blood-type present |
| 1801 | 30 | – | – | |
| 1945 | 31 | – | – | |
| 1760 | 34 | + | + | ,, ,, |
| 1769 | 36 | – | – | |
| 1712 | 42 | + | + | ,, ,, |
| 2034 | 43 | + | + | ,, ,, |
| 1549 | 44 | + | + | ,, ,, |
| 2034 | 44 | + | + | ,, ,, |
| 1706 | 51 | – | – | |
| 1566 | 53 | + | + | ,, ,, |
| 1651 | 56 | + | + | ,, ,, |

From the above table it is seen that the salivary glands first became invaded twenty-five days after the infecting feed. In this case the monkey did not become infected. This may have been due to an accident, such as this particular fly not biting the monkey, or the invasion of the salivary glands only taking place after the fly had bitten, or to the fact that the blood-type of trypanosome was not present. With this exception all the other experiments, twelve in number, confirm the hypothesis that the fly does not become infective until the salivary glands are invaded.

Another point which comes out with striking clearness is, that in all the salivary glands from flies which gave a positive result, trypanosomes similar to the short and stumpy blood type were invariably present.

It is to be hoped that before long the result of this work will be confirmed, and so added to, that the whole story of the development of the trypanosomes within the fly, and their passage into the salivary glands, will be unfolded.

*Conclusions.*

(1) In the course of the development of *T. gambiense* in *G. palpalis* the proboscis does not become involved, as in the case of some other species.

(2) A few days after an infective feed the trypanosomes disappear out of the great majority of the flies, but in a small percentage this initial disappearance is followed by a renewed development.

(3) After a very short time the flies which have fed on an infected animal become incapable of conveying the infection by their bites, and this non-infectivity lasts for some twenty-eight days, when a renewed or late infectivity takes place.

(4) A fly in which this renewed or late infectivity occurs can remain infective for at least ninety-six days.

(5) An invasion of the salivary glands occurs at the same time as this renewal of infectivity, and without this invasion of the salivary glands there can be no infectivity.

(6) The type of trypanosome found in the salivary glands when the fly becomes infective is similar to the short stumpy form found in vertebrate blood, and it is believed that this reversion to the blood-type is a *sine quâ non* in the infective process.

**"Indian Medical Gazette," vol. xlvi., No. 5, May, 1911.**

*Diphtheria in India.*—Fox believes that the general belief that diphtheria is comparatively rare in India, and that cases which do occur are of a very mild type, would appear to need some modification. The mortality in India is, he states, certainly much less than in European countries where the disease follows a more virulent course, but he doubts if India can claim an immunity from sequelæ. He quotes examples of apparently mild infections where death occurred from subsequent paralysis. There is no doubt, as Fox says, that proper bacteriological examinations are the only way to make a certain diagnosis of diphtheria, and if this were uniformly done the percentage would rise correspondingly in height.

**"Bulletin de la Société de Pathologie Exotique," Séance du 10 Mai, 1911.**

*Helminthiasis.*—Darling contributed a paper on the intestinal worms of three hundred insane patients in the canal zone, Panama, detected by special methods. The percentage infected was heavy. Leger, who spoke on the paper afterwards, showed that in Tonkin intestinal parasitic infections are even more numerous, his percentages being higher than Darling's, and also than those of Ashford King and Gutierez in Porto Rico. In the same number some other interesting papers will be found, viz., on paludism, spirilla and relapsing fever, &c.

**"The Journal of Experimental Medicine," vol. xiii., No. 6, June 1, 1911.**

*Pancreatic Disease.*—Cecil, in a paper on adenomata of the pancreas originating from the islands of Langerhans, states that small encapsulated tumours of the size of peas, or even smaller, are occasionally found in the pancreas. These tumours are benign, and have a structure similar in all respects to that of a hypertrophied island of Langerhans. The fact that one may encounter all gradations in size of the islands, from that of the normal island to that of the tumours, suggests that it is more reasonable to consider these merely as examples of hypertrophy rather than as adenomata originating from the islands. A study on the islands of Langerhans in tropical maladies might furnish some useful information.

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THE JOURNAL OF

# Tropical Medicine and Hygiene

JULY 1, 1911.


## THE SOCIETY OF TROPICAL MEDICINE AND HYGIENE.

THIS Society has now entered upon the fifth year of its existence, and promises to continue to be a success both in regard to the number of its members and the character and quality of the papers and discussions dealt with at its meetings. At the annual meeting, held on June 16, 1911, Major (now Sir) Ronald Ross, C.B., retired from the Presidency, according to the Article of the Society which provides for re-elections biennially, and Sir Wm. Leishman was raised to the Presidential chair. The Secretaries reported that over 600 members had joined the Society, including medical men in many parts of the world and of many nationalities.

In the evening a dinner was held, at which Lieutenant-Colonel Sir Wm. Leishman, F.R.S., R.A.M.C., presided, when there were present as guests: Sir Archibald Geikie, K.C.B., President of the Royal Society; Sir Thomas Barlow, Bart., President of the Royal College of Physicians; Mr. Butlin (now Sir Henry Butlin, Bart.), President of the Royal College of Surgeons; Bishop John Taylor Smith, C.V.O., Chaplain-General of the Army; Sir James Porter, Director-General, Medical Department of the Navy; Colonel Baptie, V.C., C.M.G., Army Medical Department; H. J. Read, Esq., C.M.G., and W. D. Ellis, Esq., Colonial Office; and P. Michelli, Esq., C.M.G. Several members from abroad were present, and a pleasant evening was spent.

After the loyal toasts were proposed by the Chairman, prosperity to the Society was proposed by the President of the Royal College of Physicians and Surgeons, and responded to by the Chairman. The "Guests" were proposed by Mr. James Cantlie, and responded to by Sir James Porter and Bishop Taylor Smith. Major Ronald Ross (now Sir Ronald Ross) proposed the health of the Chairman.

The success of the Society and its work was the theme of all the speakers, and the important place that it occupies as an imperial and scientific asset in the country was fully recognized.

### SIR RONALD ROSS.

The news of the bestowal of knighthood upon Sir Ronald Ross will be received everywhere with enthusiasm. It is needless to give an account of Sir Ronald's contributions to the literature of TROPICAL MEDICINE, his brilliant discoveries, or the part he played in founding the Liverpool School of Tropical Medicine. A mere summary of his achievements in no way represents the importance of the work he has accomplished, nor does it indicate the patient labour, the scientific acumen and the devotion he has brought to bear upon tropical ailments. We hope he may be long spared to us, and that he will continue to devote himself still further to the elucidation of many of the intricate problems awaiting solution.

### SIR RUBERT BOYCE.

The loss to science, and especially to TROPICAL MEDICINE, by the death of Sir Rubert Boyce is irreparable. His reputation was world-wide, and the mourning for his early death will be universal. Amongst the pioneers of tropical medical investigation and discovery his name will occupy a foremost place for all time.

## Annotations.

*The History of Sleeping Sickness.*—In the *Malay Medical Journal*, vol. ix, part 2, April, 1911, Dr. E. D. Whittle contributes a paper which he has termed "A Forgotten Notice of Sleeping Sickness." As Dr. Whittle says, it has been customary up till the present time to attribute to Winterbottom in 1803 our first written notice of sleeping sickness. Winterbottom did not, of course, claim that he had discovered a new disease, as in his time it was well known locally on the West Coast of Africa. Now Dr. Whittle shows us that a certain John Atkins, a surgeon of the Royal Navy, visited Sierra Leone and other parts of the coast in 1721, and on his return to England went in for writing books.

In the "Navy Surgeon," published in 1732, he contributed an appendix entitled "Observations on the Coast of Guiney," a chapter of which was devoted to the negro distempers; the first being that called by Europeans "the Sleepy Distemper." Dr. Whittle quoting from this states that Atkins wrote as follows:—

"The sleepy distemper (common among the Negroes) gives no other previous notice, than a want of appetite two or three days before; their sleeps are sound, and sense of feeling very little, for pulling, drubbing or whipping will scarce stir up sense and power enough to move, and the moment you cease beating, the smart is forgot, and down they fall again into a state of insensibility, drivling constantly from the mouth as if in a deep salivation; breath slowly, but not unequally, nor snort.

"Young people are more subject to it than the old, and the judgment generally pronounced, is death, the prognostick seldom failing; if now and then one of them recovers, he certainly loses the little reason he had and turns ideot.

"In searching for the cause of this distemper, it will be necessary to repeat what I have above observed, that the bulk of slave-cargoes mostly consist of country people, as distinguished from the coast people apparent, if the principal way of supply be considered.

"The immediate cause of this deadly sleepiness in the slaves is evidently a super-abundance of phlegm, or serum, extravased in the brain, which obstructs the irradiation of the nerves; but what the procatartic causes are that exert to this production, and eclipsing the light of the senses, is not so easily assigned.

"I shall ascribe the cause to cold and immaturity; to diet and way of living, and to the natural weakness of their brain; some or all of these causes co-operating to it.

"Their indolence is such (when shipped on board for slaves) as to be entirely dispassionate at parting with wives, children, friends, and country, and are scarcely touched with any other sense or appetite, than that of hunger; and even in this, for want of custom or instinct, they cannot distinguish proper food, nor know when to leave off, voraciously eating, though victuals be never so dirtily cooked, and whether the flesh be raw or dressed, whether of the gutts or a sirloin; a practice also that may sometime, by overstretching the fibres of the stomach, occasion crudity and indigestion.

"Thirdly, the natural weakness of the brain, I am apt to think, the principal cause of the distemper. Doubtless that part gains strength by exercise, *i.e.*, by the employment of our rational faculties, as well as the muscles and external fibres of the body; and since the Africans are hereditarily ignorant, destitute of all art and science, or any mechanical knowledge to exercise the brain, it consequently grows weaker in its inward structure and recesses; and fails together with the judgment and the passions.

"The cure is attempted by bleeding in the jugular, quick purges, sternutories, vesicatories, fontanels, and sudden plunges into the sea."

This forms a very interesting account of the disease and Dr. Whittle is to be thanked for bringing it before the medical world of the present day, by whom it has certainly never been heard of before.

*Tuberculosis in Trinidad.*—Dr. Masson, in his sixth annual report (1910-11) of the Executive Committee of the Trinidad Association for the Prevention and Treatment of Tuberculosis, states that tuberculosis was again the principal cause of death in Port of Spain. During the year there were 620 deaths from this disease in the whole colony, and of these, Port of Spain alone contributed 300, or nearly one-half of the total number. As regards colour, 63.7 per cent. of the cases were black, 16.5 per cent. white, and 19.5 per cent. mixed. A good number of these came from Barbadoes, the disease apparently being almost equally frequent there. The only way of fighting the malady is by gradually instructing the people, and this is what the Association is attempting to do. Funds are required by the Committee, but subscriptions and donations are now coming in, and it is to be hoped that these will not be lacking. With proper support the Association should be able to do valuable work in trying to mitigate, if not to stamp out, this world-wide curse.

*Malaria in Gibraltar.*—Major C. E. P. Fowler, in the *Journal of the Royal Army Medical Corps* for June, 1911, contributes an interesting paper on "Malarial Fever in Gibraltar." So far he believes primary malaria has never been reported from Gibraltar, but he himself has recently collected three cases which seem, without any doubt, to have occurred and originated on the Rock itself. The interesting point about the series was that they all fell ill within a week of each other, and were all living in close proximity. No other cases could be

found, although a careful watch was kept for them. The curious feature of the outbreak is that anophelines have never been found at Gibraltar, and Major Fowler is at a complete loss to account for the causation then of the cases.

Possibly, as he suggests, infected anophelines were brought by some ship, and escaping, got into the Rock and bit the three individuals. Some explanation of this sort is much more feasible than the alternative one proposed by the author, that another genus of mosquito might transmit the infection. It would be interesting to look out for any other cases, and if these do not occur, then some accidental occurrence of infected *Anopheles*—possibly brought from the surrounding country in vegetable carts or in some similar manner—must be looked on as the explanation.

---

*Salvarsan and the Wassermann Reaction.*—Howard Fox, of New York, treats this subject fully in the *Boston Medical and Surgical Journal* of June 1, 1911. After a careful study he concludes

(1) That it is difficult at the present time to draw general conclusions owing to the great discrepancies in the results of various observers.

(2) That these discrepancies are partly due to the different methods of injection and to the different stages of the disease in which the injections were given.

(3) That the results of a single injection given by either the intravenous or intramuscular methods are as a rule rather unsatisfactory from the serological standpoint.

(4) That repeated injections seem to have given better results and offer a more hopeful outlook for the future.

(5) That the action of salvarsan upon the Wassermann reaction is in general analogous to that of mercury.

(6) That the effect upon the Wassermann reaction is much less favourable than upon the clinical manifestations of syphilis.

This last point seems to be an important one and would seem to point to the necessity of more frequent injections of the drug.

## Review.

ON WRITING THESES FOR M.B. AND M.D. DEGREES. By H. D. Rolleston, M.D., F.R.C.P. John Bale, Sons and Danielsson, Ltd., 83-91 Great Titchfield Street, London, W. Pp. 27. Price 1s. net.

Dr. Rolleston has given us not only an exceedingly interesting article on the subject of how to choose and write a thesis, but has served to convey in the useful instructions necessary to the successful accomplishment of this end much that is otherwise educative and instructive. Writing a Thesis should be made compulsory for every medical degree and diploma, for it compels young medical men to think and inquire deeply, and once having acquired that attainment in even one subject it may and often will help and encourage him to look more thoroughly into many things and many subjects, and thereby render him a more intelligent and thoughtful practitioner.

## Notes and News.

*Livingstone College:* The Livingstone College Year Book for 1911 (the Coronation number) contains convincing evidence of the importance of elementary medical training for missionaries, and this is enforced not only by the testimony of former students, but by the authoritative pronouncement of the recent World Missionary Conference in Edinburgh. Among the achievements of old students may be noted the action of the Rev. E. W. T. Greenshield, who rescued the entire shipwrecked crew of a Dutch whaler in which he was sailing, and for this he has been decorated by the Queen of Holland; whilst in Assam an old student, a missionary of the Baptist Missionary Society, has discovered a new mosquito, henceforth to be known as the *Culex Pettigrewii*.

The Year Book goes forth as a Coronation number, and an appeal is made for the consideration of Imperial Health problems. The enormous mortality from malaria and plague, not to speak of other diseases in India and other Tropical Dependencies of Great Britain, is pointed out, and it is contended that the horror of these great disease scourges has not been adequately realized.

A glance at the review of literature on the subject of "Tropical Medicine and Hygiene," shows what excellent materials are available for those who desire to study these problems for themselves. Special attention is directed to Professor Ronald Ross' book, "The Prevention of Malaria," and two remarkable diagrams are reproduced from this work, showing the rapid decrease of the mortality from malaria in Italy since the Italian Government started the distribution of quinine, and much further evidence is given indicating the great value of quinine in the prevention of malaria.

Some beautiful illustrations of mosquitoes are reproduced from Professor Donne's "Insects and Disease," which is strongly recommended. The new treatment of cholera by the use of permanganate of potash, as recommended by Major Leonard Rogers, is described, showing the distinct improvement in the results in treating this most serious disease. Hints on outfit and other hints on the preservation of health are also given, and it is hoped that many may be led to inquire further into the work of Livingstone College, and that many missionaries may be able to avail themselves of the training which is given in the elements of medicine, surgery and hygiene, within the walls of the College. All communications should be addressed to the Principal, Livingstone College, Leyton, E.

At the Annual General Meeting of the Society of Tropical Medicine and Hygiene, held at 11, Chandos Street, Cavendish Square, W., on Friday, June 16, 1911, at 5 p.m., after the annual reports of the Council and Treasurer had been submitted the secretaries announced the result of the ballot for the new President and Council. Lieutenant-Colonel Sir William Leishman, F.R.S. was elected President, and the retiring President, Professor Ronald Ross, C.B., F.R.S., installed him to the vacant chair.

Sir William then addressed the meeting, which later broke up, to meet again in the evening for the biennial dinner. This, as usual, was a great success, and many important guests were present at it.

## Recent and Current Literature.

*A list of recent publications and articles bearing on tropical diseases is given below. To readers interested in any branch of tropical literature mentioned in these lists the Editors of the* JOURNAL OF TROPICAL MEDICINE AND HYGIENE *will be pleased, when possible, to send, on application, the medical journals in which the articles appear.*

### "The Australian Medical Gazette," May 20, 1911.

*Dengue.*—Scott and Davidson report outbreaks of dengue in Australia, the former in Brisbane, the latter in Queensland. These epidemics seem to have presented the usual features of the disease, *e.g.*, rapid progress through the community, the severe pains, the temperature, the intermission, the relapse, and the typical rash. Complications were not common, the chief ones being confined to the nervous system, especially the heart in old people. It is now known, of course, that dengue is due to an ultramicroscopical germ which develops in mosquitoes of the genus *Culex*, *Culex fatigans*, and if Dr. Davidson will consult the literature of the subject, especially the work of Craig in the Philippines, he will find that all detailed there.

### "Medical Record," June 3, 1911.

*Yellow Fever.*—Under the news of the week the above number of the *Medical Record* states that a French steamer which arrived at La Guayra, Venezuela, from Colon, on May 25, 1911, was reported to have eight cases of yellow fever on board. By the time the same vessel had arrived at Fort de France, Martinique, on May 29 there had been fifteen cases, two of which had terminated fatally. It would be interesting to follow this outbreak up so as to see where the original infection was acquired from.

### "Journal of the American Medical Association," vol. lvi., No. 22, June 3, 1911.

*Malaria.*—Graham Henson reports a case of tertian malaria simulating appendicitis. The case is an instructive one and offered distinct difficulties in diagnosis until a blood examination cleared the matter up. The patient was seized suddenly with a severe pain in the abdomen. When Henson saw him there was intense agony, the right abdominal wall was rigid and the right thigh flexed at right angles to the abdomen. He had vomited twice, but had not had a rigor. Pressure over the appendix caused great pain. The attack ameliorated, but later, on getting up, a relapse appeared, this time ushered in with a rigor (temperature 106° F.), and with the same severe pain in the abdomen with semi-coma in addition. A blood examination showed tertian parasites. Quinine cleared up all the symptoms, abdominal and otherwise, and there were no returns.

### "Journal of the American Medical Association," vol. lvi., No. 22, June 3, 1911.

*Tabes in Negroes.*—Hummel writes on the rarity of tabetic and paretic conditions in the negro. As he says, these conditions are undoubtedly rare, but nevertheless they do occur, even in full-blooded negroes. Hummel himself reports one in his paper, a case of tabes in a coloured woman. As to how this should be is not quite clear, and the explanation given by the writer in his paper does not seem to solve the matter.

## Personal Notes.

THE SOCIETY OF TROPICAL MEDICINE AND HYGIENE.

At the Annual General Meeting of the Society held at 11, Chandos Street, Cavendish Square, London, W., on Friday, June 16, 1911, at 5 p.m., the following gentlemen were elected Fellows: Eldred C. Braithwaite, M.B., West African Medical Staff; Raymond Bury, F.R.C.S.I., Nyasaland; L. Wynne Davies, West African Medical Staff; Desmond Drew, M.B., Nyasaland; David Duff, M.B., West African Medical Staff; H. R. M. Ferguson, M.B., West African Medical Staff; Matthew W. Fraser, M.B., The Gold Coast; T. Ganon, M.D., Sumatra; Friedrich Gröne, M.B., Hong-Kong; Captain Davis Heron, M.B., I.M.S.; P. H. MacDonald, M.B., West African Medical Staff; Leo. S. Machado, F.R.C.S.I., Tuticorin; Walter I. Martyn-Clark, M.B., West African Medical Staff; Arthur Neve, F.R.C.S.E., Kashmir; Miss D. R. C. Patell, M.B., M.R.C.P., Bombay; Alex. H. B. Pearce, L.R.C.P., Antigua; Reginald Oliver Sibley, M.B., London; Byramji S. Tarapurwalla, L.R.C.P., Hyderabad; W. A. Tatchell, M.R.C.S., Hankow; Harry B. Taylor, M.D., China; C. E. S. Watson, M.R.C.S., Northern Nigeria; Joseph Wigham, M.D., Dublin; George C. Winchester, M.B., Assam; John Y. Wood, M.B., Sierra Leone.

COLONIAL CIVIL SERVICE.

Dr. E. W. R. Branch has assumed the duties of Health Officer for the Presidency of the Virgin Islands.

Dr. E. B. Garrard has become a Supernumerary Medical Officer of the Leeward Islands, and is acting as Medical Officer in Nevis during the absence on leave of Dr. C. O. Wynne.

The following changes have been made in the Medical Department of the Straits Settlements: Dr. F. B. Croucher, Senior Medical Officer, Penang, becomes Senior Medical Officer in Charge, General Hospital, Singapore; Dr. R. Dane takes the place vacated by Dr. Croucher in Penang; Dr. W. S. Shepherd, Medical Officer, Province Wellesley, becomes Senior Medical Officer, Singapore; Dr. E. D. Whittle, Medical Officer, Grade I., succeeds Dr. Shepherd in Province Wellesley.

Dr. D. A. Ogilvie has joined the service of the Straits Settlements as a Medical Officer.

Dr. A. Connal, Assistant Director, Medical Research Institute, Southern Nigeria, has been transferred to the Gold Coast Colony for service.

Dr. F. E. Woodham Rogers has joined the Sarawak Government Service as an Assistant Medical Officer.

Dr. G. D. De Waal has succeeded the late Dr. R. K. Tait as District Surgeon at Colesberg, Cape Province, South Africa.

## Notices to Correspondents.

1.—Manuscripts sent in cannot be returned.

2.—As our contributors are for the most part resident abroad, proofs will not be submitted to those dwelling outside the United Kingdom, unless specially desired and arranged for.

3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.

4.—Authors desiring reprints of their communications to the JOURNAL OF TROPICAL MEDICINE AND HYGIENE should communicate with the Publishers.

5.—Correspondents should look for replies under the heading "Answers to Correspondents."

## Original Communications.

# ON THE FREQUENT OCCURRENCE OF *PHYSALOPTERA MORDENS* AS AN INTESTINAL PARASITE OF MAN IN TROPICAL AFRICA.

By ROBERT T. LEIPER, D.Sc., M.B., F.Z.S.

*Helminthologist to the London School of Tropical Medicine and the Seamen's Hospital Society.*

AT the meeting of the Society of Tropical Medicine held on December 20, 1907, I exhibited and described a curious "ascarid"-like nematode that had been found by Dr. Gray of the Royal Society Sleeping Sickness Commission, at a *post mortem* of a native who had died of sleeping sickness in the Entebbe Hospital, Uganda. The parasites belonged to the genus, *Physaloptera*, of which a single species has hitherto been found in man; and were described as representing a new species closely allied to that founded by v. Linstow in 1902 for those discovered in Southern Russia, and named by him *Physaloptera caucasica*.

At that time I regarded the find merely as a helminthological curiosity, but shortly afterwards Dr. Turner, of the Transvaal, sent me a photograph of a specimen collected some time previously by his father. At my request Dr. Turner made a further search for additional cases, collecting all examples of immature *Ascaris lumbricoides* found in the stomach. The results of my examination of a considerable quantity of material forwarded by him during the past two years show conclusively that *P. mordens* is a well-established parasite in tropical Africa, and is of not infrequent occurrence.

As with *Triodontophorus deminutus* and *Œsophagostomum brumpti*, man is not, however, the sole host. While revising recently the Helminthological Collection in the Vienna Court Museum I came across the same species collected from a species of *Simia* from Angola by Natterer nearly a hundred years ago. This had been identified as a *P. dilatata*. A comparison of the specimens with the types of *P. dilatata* showed, however, that the diagnosis was erroneous, and that *P. mordens* may be maintained as a distinct species.

*P. mordens* lives in man not only in the stomach, but also in the œsophagus and small intestine. Dr. Turner has kindly permitted me to publish the following abstracts from his letter written on April 3. Dr. Turner writes when forwarding specimens:—

"It may be interesting to record that this is not the first time I have got these worms in the stomach, and the other day I got one firmly attached to the tissues of the œsophagus. He had got a good grip, and I had to use force to get him detached."

Still more interesting is a note written just previously regarding another case, in which the statement occurs:—

"On the following day, while squeezing the liver of a Quilimane native, I undoubtedly got two pairs of these worms, and proceeding with my examination I found in the small intestine two more pairs of the same worms. In another Quilimane I also found some larger forms. Recently I have had several *post mortems* with *P. mordens*."

My original description of this species appeared in the first volume of the *Transactions of the Society of Tropical Medicine*, but is reproduced here with some verbal emendations, as the early numbers of this series were never available for purchase, are now out of print, and there exists considerable doubt, under the present definition of what constitutes "publication" of scientific matter, as to the validity of papers printed therein.

The genus *Physaloptera* has representatives in the four higher groups of the vertebrata, but has not yet been found to occur in fishes. There is a large number of species, a considerable percentage of which occur in the mammalia. The genus is, however, a very old one, and contains a number of species that depart widely from the type as defined by the type-species *P. clausa*. Further, the characters by which many of the species in the genus have been defined are really of generic value, so that, in the absence of the original material, there is little beyond a measurement or two upon which the specificity of the species remains. This is, unfortunately, true of the description of *P. caucasica*, with which the present species required to be most carefully compared.

The generic characters that appear to be constant for the species of the genus *Physaloptera s. str.* may be summarized as follows:—

The general form resembles markedly that of the species of the genus *Ascaris*, but in the male the skin at the posterior end of the body is flattened out to form a somewhat heart-shaped cuticular expansion. In both sexes the cuticle moreover over-reaches the mouth structures, forming a sort of transparent sleeve or collar: the skin in many species is unmarked by the regular transverse striations seen in other genera.

The mouth is surmounted by two large fleshy lips situated laterally. Each lip bears two large sub-median, flattened papillæ, and is surmounted by a cuticular prong called the external tooth. Internal to this, the surface in contact with the opposing lip presents a more delicate cuticular fold, that shows varying form with the different species, and is known as the inner tooth.

The posterior end of the male presents a series of papillæ which fall into two classes, pedunculated and sessile. Typically there are in each species ten pairs, four pedunculated and six sessile. The pedunculated series lies in a longitudinal row outside the sessile papillæ. Though the number appears to be constant for most, at any rate, of the species, the relative position of the papillæ to one another seems to be of specific value. The vulva is situated in the anterior half of the body, the ova show an exceedingly thick, smooth shell, that in itself is highly characteristic.

*P. mordens*, like *P. caucasica*, presents all the above characters. Its size is very considerable, the male measuring from 30 to 50 mm., the female from 40 to

55 mm. In shape and general appearance it resembles an immature *Ascaris lumbricoides*, so much so as to lead one to conclude that it may have been frequently overlooked in the past.

The breadth of the worm is considerable, and varies from 2 to 3 cm. The body tapers very gradually anteriorly and ends truncately; posteriorly it tapers rapidly in the female to a sharp tip lying more in line with the ventral than the dorsal surface and giving, therefore, the posterior portion of the worm a somewhat rounded appearance on the whole. In neither sex does the cuticle form posteriorly a præputial fold around the posterior portion of the body as it does in some species, in addition to the characteristic anterior bulging seen in all. The cuticle shows adventitious groovings that have no constant relation to one another. In this species, however, it is not absolutely without structure, exceedingly fine transverse striæ being noticeable.

The mouth parts exhibit several interesting details of structure that are unfortunately unnoted either in the description or in the figure of the corresponding species *P. caucasica*. The two large fleshy lips of *P. mordens* bear in addition to the pair of touch papillæ, and the horny "external tooth" common to these forms, a pair of cuticular knobs that jut out and lie in apposition to one another at the outer and posterior limits of the transverse fissure of the mouth, on either side.

Further, the cuticular fold known as the "inner tooth" lying in the median line on the inner aspect of the lip and overhung by the horny external tooth, presents a sharp cutting edge towards the lumen of the mouth, and projects forwards tapering to end anteriorly in a single lancet-like tip.

Both lips are bound together posteriorly by a thick encircling cuticular band, where the cuticle leaves the surface of the anterior part of the body to form the præputial-like fold characteristic of the genus. At a distance equal to three times the transverse diameter of this band, measuring backwards therefrom, are to be found the cervical papillæ. The alimentary canal shows the usual divisions into œsophagus, intestine and rectum. The œsophagus measures exactly one-sixth of the body-length. It shows distinct transverse musculature, and gradually increases in thickness towards its intestinal opening. The chyle intestine commences with a lumen only slightly greater than the external circumference of the terminal part of the œsophagus, and gradually becomes narrowed during its whole course to the short rectum at its junction with which one finds the large unicellular masses that have been noted at this situation in other groups of nematodes.

The anus lies on the ventral surface at a distance of one-eleventh of the body-length, in the male, from the tip of the tail.

The cuticular expansion at the tail of the male is oval in outline, tapering posteriorly, The papillæ, both in number and in general disposition, are in accord with the type of the genus, but in minuter details of the relation of the individual papillæ to one another the following points are to be noted. The external series of four pairs of pedunculated papillæ do not lie in one straight longitudinal series but are disposed so that the first and fourth pairs lie considerably within the middle, *i.e.*, second and third pairs.

Of the sessile series of papillæ the only point to note is that in contrast with the arrangement described, and figures for *P. caucasica*, the most anterior of the three hindermost pairs of sessile papillæ on the tail are much more widely separate from one another than are the members of the two succeeding pairs. As in *P. caucasica* and many other species, the ventral surface of the body has a peculiar "rough-shod," marking of the cuticle that lies between the most anterior pair of papillæ, and the second pair from the posterior end, the cuticular markings extending between this second last pair, and gradually disappearing, doing so more quickly from the sides than in the centre line.

The male genital system consists of a long, single genital tube, divided distinctly into three well-defined portions and a pair of very unequal spicules. The genital tube lies almost entirely on the ventral aspect of the body cavity, keeping the alimentary canal, in its whole length, on its dorsal aspect. The ejaculatory duct measures about one-fourteenth of the body-length, and shows well-developed musculature in its walls. The vesicula seminalis is a wide and lengthened tube, with a peculiarly reticulated wall. It extends forwards without kink or coil for a distance equivalent to about a fourth of the entire body-length. Beyond the anterior limit of the vesicula seminalis the testicular tubule continues forwards with two or three longitudinal, but practically no obvious lateral folds to within a distance (about equal to the length of the ejaculatory duct) of the œsophagus, where it returns upon itself, the fine terminal part of the testicular tubule being found at about the centre of the body. The spicules are very unequal, the larger and more slender measuring 4·6 mm., the shorter and stouter, 0·6 mm.

In the female the arrangement of the two uterine tubules cannot be followed easily, owing to the dilatation with ripe ova. The vagina can be seen, however, to open by a transverse slit on the ventral surface of the body in the region between the junction of the anterior fifth and the anterior fourth of the body-length with the remaining portion.

The ovaries are much coiled at the posterior part of the perivisceral cavity just in front of the rectum, the actual ends of the tubules are seen to be somewhat dilated and club-shaped.

The mature eggs have a thick, smooth, cuticular shell, and would appear to be much smaller than those of *P. caucasica*. They measure ·043·6 mm. by ·035·3 mm.

The characters upon which the specific identity of the species was established are: The large size of the adults. The peculiar construction of the lips and the simple formation of the inner tooth, the anterior edge of which is undivided.

In the male the disposition of the papillæ. The internal arrangement of the testicular coils. The size of the spicules. In the female, the size of the ova,

the position of the vulvar aperture, and the sharpened posterior extremity of the body.

As already stated, the characters given for *P. caucasica* are few in number. The description of the mouth parts contains only facts of generic importance. Its small size, the different relation of its papillæ to one another, and the difference in size of its spicules and ova will suffice to distinguish it from *P. mordens*, until it can be shown that in these details the original description of *P. caucasica* is erroneous.

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## NOTE ON THE SEASONAL INCIDENCE OF DRACONTIASIS ON THE GOLD COAST.

By Robert T. Leiper, D.Sc., M.B.

*Helminthologist to the London School of Tropical Medicine and Seamen's Hospital Society.*

The seasonal incidence of outbreaks of dracontiasis has been noted frequently. A comparison of published statistics shows, however, that the annual outbreaks in various parts of the Tropics occur at different periods of the year. An accurate determination of the exact period of local incidence may prove an important factor in the success of general prophylactic measures enforced in an infected area.

The subjoined Chart (A), compiled from the official reports for 1893-5, illustrates, in a striking manner, the development of an epidemic of dracontiasis on the Gold Coast in 1895, and reveals graphically the definite seasonal incidence of the disease in that Colony. Chart (B) gives, superimposed, the rainfall for the preceding years 1891-4. It will be noticed that in all of these years there was practically no rain from the end of November until April. In April and May heavy rains occurred. From June till September the amount of rain steadily diminished. In October or November several inches of rain were again recorded. Thus, according to our chart, there may be said to be four seasons on the Gold Coast, viz.:—

A long dry season, November-March (including the Harmattan winds).

A long wet season, April-June.

A short dry season, July-September.

A short wet season, October or November.

By comparing the amount of rainfall with the number of cases of dracontiasis during 1894 and 1895 as shown in Chart (A), it will be seen that the

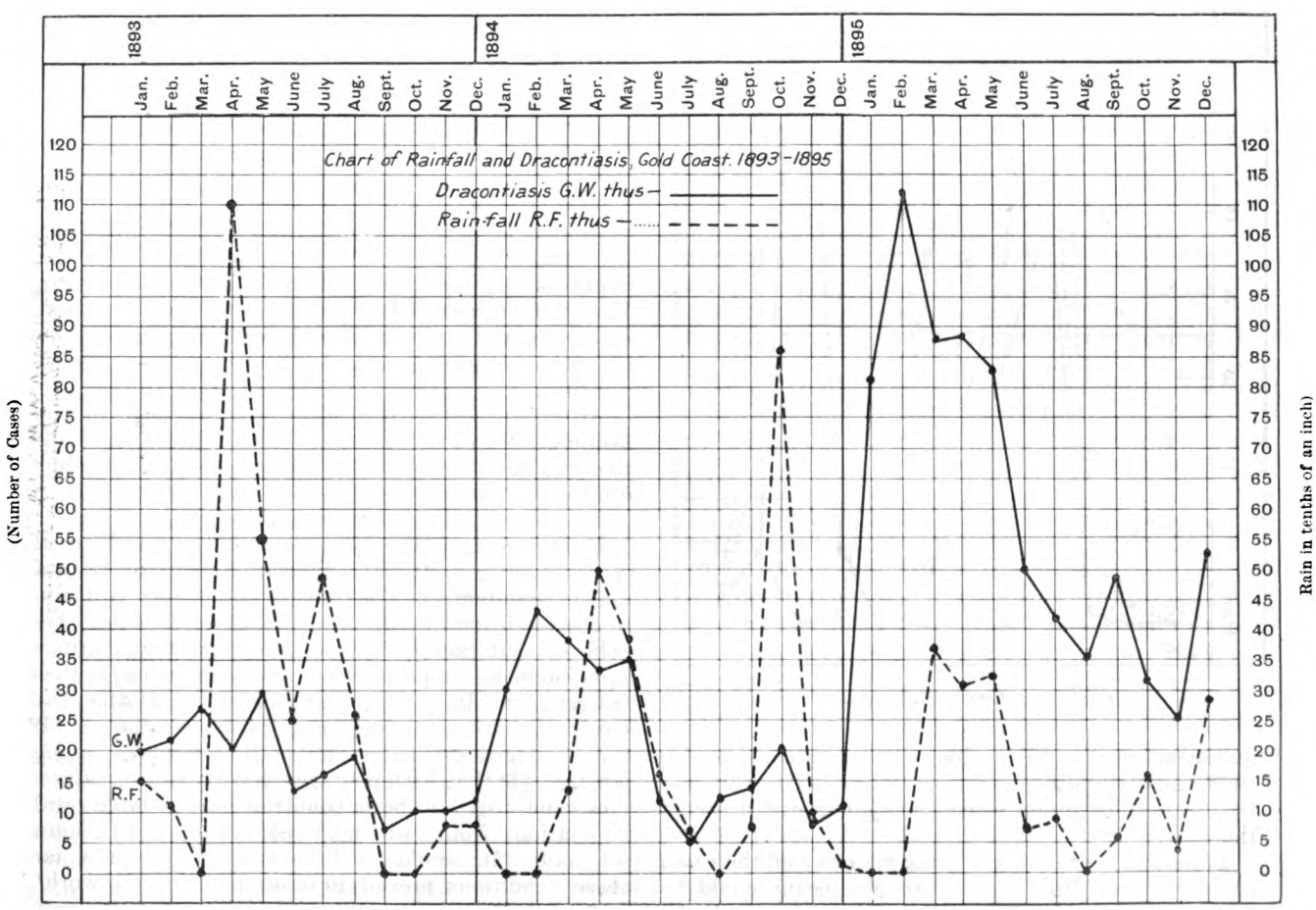
1893
1894
1895
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
Chart of Rainfall and Dracontiasis, Gold Coast. 1893-1895
Dracontiasis G.W. thus —
Rain-fall R.F. thus — ..... - - - - -
G.W.
R.F.
(Number of Cases)
Rain in tenths of an inch)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120

Chart A.—Illustrating the Seasonal Incidence of Dracontiasis. Each square corresponds to Five Cases and 0·5 in. Rainfall.

period of the maximum number of guinea-worm cases in each year corresponded with the period of the minimum rainfall, *i.e.*, the long dry season. The first three months of the year may be said, therefore, to be the period during which, most probably, the guinea-worm is widely disseminated on the Gold Coast. Of course, cases do occur throughout the year, as shown in the Chart, but these can be explained partly, at least, by the fact that the metamorphosed larva of the guinea-worm can remain

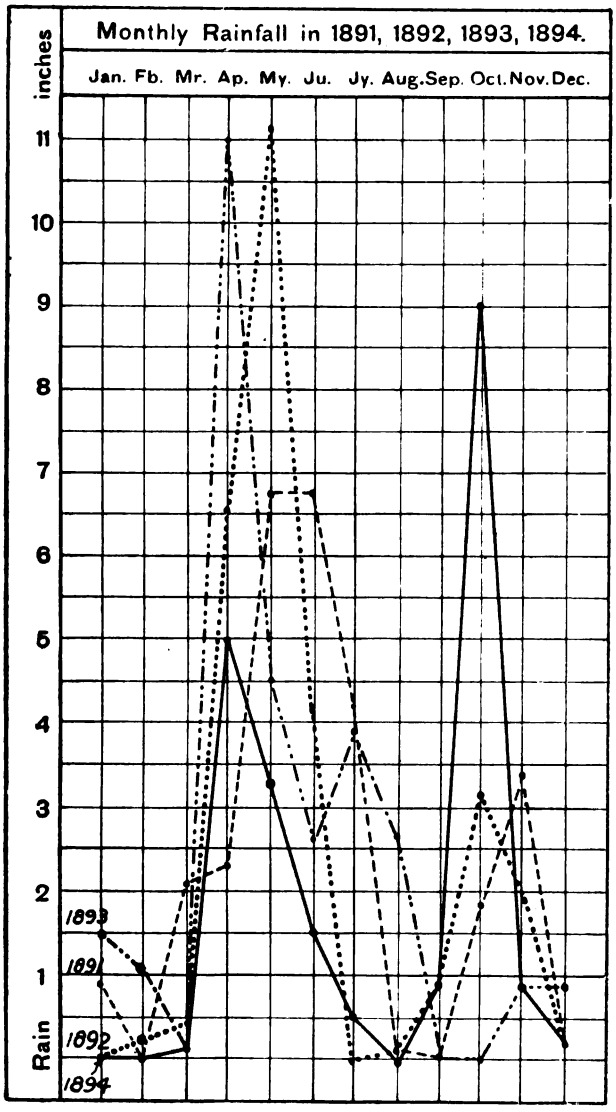


CHART B.

quiescent within the cyclops for some considerable time, and that the adult worm may, through late fertilization or other cause, delay her exit through the skin.

It follows then that the great majority of the cases could be prevented if some simple means could be devised by which the concentrated contents of the village ponds and water-holes and the diminished supplies in the town wells, whether infected already or no, could be treated during the dry season in such a way as to render them innocuous but not unpalatable.

THE HEALTH OF THE ISTHMIAN CANAL ZONE.—Colonel Georgas reporting on the department of sanitation for the Canal Zone, for the month of April, 1911, states that the total number of deaths from all causes among employees was 38. These were divided as follows: From disease 26 and from violence 12, giving the annual average per thousand of 6·42 and 2·96 respectively.

Among employees for the month of April of each year the annual average death-rate per thousand was as follows:—

1905, 10·95; 1906, 30·00; 1907, 38·67; 1908, 7·77; 1909, 8·57; 1910, 13·04; 1911, 9·38.

The annual average death-rate per thousand in the cities of Panama, Colon, and the Canal Zone, including both employees and civil population for the month of April of each year, was as follows:—

1905, 39·29; 1906, 39·06; 1907, 40·97; 1908, 20·04; 1909, 16·77; 1910, 19·73; 1911, 17·74.

In segregation according to race the annual average death-rate per thousand from disease among employees was, for whites 2·85 and for blacks 7·67, giving a general average for disease of 6·42. For the same month during 1909 the annual average death-rate per thousand from disease among whites was 6·65 and blacks 7·15, giving a general average of 7·01; and in 1910 from disease among whites 4·48 and blacks 9·97, giving a general average of 8·62.

Among employees during the month the deaths from the principal diseases were as follows: Chronic nephritis, 3; dysentery, clinical, 1; malaria fever, E. A., 1; measles, 1; lobar pneumonia, 9; tuberculosis, 3, and typhoid fever, 1, leaving 7 deaths from all other diseases and 12 deaths from external violence.

An epidemic of measles still continues, but is on the decline. No cases of yellow fever, plague, or smallpox originated on or were brought to the Isthmus during the month.

PELLAGRA.—In the *Journal of the American Medical Association* June 10, 1911, Stewart Roberts of Atlanta applies Sambon's propositions as to pellagra in Italy, to the conditions found in the State of Georgia. He believes that Sambon's views are correct and brings some facts to support them. He concludes (1) that Georgia and Italy both have pellagra, (2) that the two both have the same topographical conditions, (3) that pellagra originates in both territories along streams, (4) that both countries have many *Simulium* flies, and (5) that both countries have a large rural population from which most cases of pellagra originate. It would be interesting to see how far these conditions prevail in other parts of the world, and when that is done, then something definite may be settled about the etiology of the disease.

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THE JOURNAL OF

# Tropical Medicine and Hygiene

JULY 15, 1911.


## CONSTIPATION AND LARGE BOWEL TROUBLES.

IT would appear that from time immemorial natives of the Tropics have found the large intestine troublesome in the extreme. In temperate climates the same tale is to hand, but in those regions the ailments are, as a rule, less severe than in the Tropics. Constipation, the commonest affliction from which mankind suffers, is particularly in evidence in warm countries, and against its evils drugs, diet, devices, and treatment of various sorts have been in constant use, and yet no sovereign remedy for its relief is known, or probably ever will be known. What is constipation?

It might be described as a condition in which the fæces are abnormally hard, difficult to expel, and calls to stool arise at long intervals. Mere infrequency of stool is not constipation. The writer has previously related the case of a farmer of fresh complexion, robust build, and one of the best rifle-shots in Britain for some thirty years, who went to stool once a fortnight. He ate and drank like other men, his stools were not hard but normal in bulk, in colour, and consistence. Account for it as one best can; but there is the fact that one of the finest specimens of manhood one could name, and one of the steadiest hand, and clearest eye, in Britain stooled but once in fourteen days, and often at longer intervals—not more than two dozen stools yearly! Infrequency of this kind is uncommon, but the infrequency of persons of sedentary occupation, poor appetite, or who deny themselves food in case of getting fat, is associated with other causes and other results. The complexion becomes muddy, the breath is "heavy," or smells, digestion is impaired, and physical strength and capabilities are at a low ebb. A condition of infrequency of stooling, not due to pathological change or to functional upset, is met with on board ship. Sailors often say that they stool but once a week at sea, and passengers declare the same. One passenger told the writer lately that from leaving England until after reaching New York no stool was passed. The explanation of "board-ship" constipation is not want of vegetables, &c., as it used to be put down to, for the vegetables are, nowadays, as fresh as those supplied in large cities. The sea air, the open-air life, the change, &c., all these have been ascribed as causes, and they may be, but the physiological explanation of a passenger having but three stools on the passage from London to China has yet to be sought for.

With the natives of the Tropics, the causes of constipation may be, for there is no scientific basis to go upon, insufficiency of food, unsatisfactory food, absence of exercise, and excessive loss of fluid by the skin.

The majority of the working classes in the Tropics, as in other parts of the world, are either insufficiently or not wisely fed. Rice, the staple food, especially when carefully refined, leaves but little direct refuse for the bowel to get rid of, and is binding in that sense only. Refined rice, like refined flour, no doubt plays a large part in the constipation "habit," and the whole meal for rice is as urgent a call as the whole meal for flour in Europe. The general absence of exercise amongst the well-to-do in warm climates is carried to an extent unknown in temperate climates, and no doubt plays its part; and the loss of fluid by perspiration must deprive the mucous membranes of much of the secretion which in temperate climates we believe to be necessary to their proper functions being carried out. The chief mechanical effect of constipation is the presence of hæmorrhoids, and as these frequently mean hæmorrhage, the sufferer, already weak, is still further weakened and constipation increases.

The very name, hæmorrhoidal vessels, given to the blood-vessels of the rectum, as an anatomical, not as a pathological, title, by the Greeks, shows how prevalent the condition was amongst them, so that constipation and its accompaniment hæmorrhoids is not a mere ailment of modern life.

All people, ancient and modern, civilized and uncivilized, have sought to overcome this prevalent complaint of constipation by crude forms of drugs and decoctions, to the excision of the entire colon

by the modern surgeon. Fruits and vegetables have been given a prominent place in the fight, and the spices so much indulged in by natives of the Tropics have their virtue in this respect. The curries, cayenne pepper, black pepper, and a host of "hot" vegetable substances, is evidence of the troubles caused by a lethargic colon; for it is a therapeutic fact that these peppers, &c., act chiefly upon the large intestine and not as a mere stimulant to appetite by exciting the stomach. To stimulate the appetite of a person supplied with an insufficient amount of food is not a custom which hunger is likely to sanction, and the hot substances are taken to get the colon to act because its contents are not sufficiently bulky to bring about a motion naturally. This subject is too vast to complete in the few lines available, but it is one which, from a physiological as well as a pathological standpoint, is well worthy of consideration, and the prevalence of the use of purgatives in both official and "quack" forms indicates that something is amiss with the diet of mankind.

J. C.

## Abstracts.

### ALASTRIM, AMAAS, OR MILK-POX.[1]

By Dr. Emilio Ribas.

*Director of the Public Health Department of the State of Sao Paulo, Brazil.*

Dr. Ribas said that lately there had been prevalent in several localities of the State of Sao Paulo, Brazil, on the frontiers of the States of Minas and Parana, a highly contagious and specific eruptive fever, which in appearance resembled small-pox, but while presenting some of the features of that disease, yet it had to be distinguished from it for various reasons.

The disease had been classified by some as chicken-pox, by others as small-pox, while some observers believed it to be a disease not yet determined.

It seems to him that the idea of chicken-pox could at once be put aside, not only because of the immunity conferred by Jennerian vaccination in regard to the disease in question, but also because it showed no preference for children between the ages of 2 and 7, as is the case with chicken-pox. There was also to be noted a more general confluence of the vesicles and the contained fluid generally becomes purulent.

That vaccination was in a high degree a prophylactic measure, had been proved in repeated instances where the spread of the disease had been checked by this means. All observers seemed to agree on that.

As regards chicken-pox it was well known that vaccination conferred no immunity. For the reasons stated the diagnosis of chicken-pox might be excluded, but the immunity conferred by vaccination might lead to the supposition that the disease in question was more closely allied to small-pox.

Dr. Ribas was of the opinion that it might be the same disease that was observed by Dr. W. G. de Korte, in May, 1904, in South Africa. That disease was commonly known by the name of "amaas," and Dr. Korte designated it as "milk-pox," doubtless owing to the milky appearance of the vesicles at a certain stage in their development.

Dr. Villas Boas, of Bebedouro, and Dr. Lopes, of Ribeirao Preto, who treated the first cases, were struck by the fact that the disease was almost exclusively found amongst recently arrived agricultural labourers on the coffee farms. Still more, these first carriers of the milk-pox showed that they were quite familiar with the disease, and referred to its benign character as well as to its epidemic character; also that the disease was known in the interior of Bahia by the name of "alastrim," meaning something that spreads, and that they had seen numerous cases of the same disease in Bahia.

From Bahia the disease spread to the States of Goyaz, Minas, Matto Grosso, as well as to the Southern States of Brazil.

Dr. Ribas then passed on to state his reasons for considering the disease as one clinically different from true variola.

(1) *The Low Mortality at all Ages amongst those who had never been Vaccinated.*—In Sao Paulo the mortality had been approximately 0·5 per cent., and in South Africa it was slightly above 3 per cent. This low mortality was found even where there has been no medical care exercised and where even ordinary comforts had been absent.

In the interior of Sao Paulo it was proved that absence of all care and the bad sanitary conditions of the houses did not in any way aggravate the mortality.

(2) *The Disease was of less Gravity amongst Children than Adults, and frequently Aborted in Sucklings.*—Of cases seen a large proportion were unvaccinated children, and in these cases as a rule the eruption only reached the vesicle stage. The vesicles were small and discrete, with the appearance of little pearls. The contents were either absorbed or escaped through small openings in the vesicular wall, leaving a slightly macular appearance, which disappeared after the falling off of a thin scab. In young infants at the breast the eruption did not generally go beyond the papular stage, only rarely were vesicles formed. While this was the general rule in children under 5 years of age, there were cases in which the eruption became frankly pustular. One of these was the case of a recently-born infant, the mother suffering from the disease at the time of birth.

(3) *Absence of Secondary Fever. Earlier Formation of Pustules. The Fetor of Small-pox was not Observed.*—As regards the absence of secondary fever Dr. Ribas's observations agreed with those of Dr. Korte. In all the confluent cases which he saw

[1] A paper read before the Society of Tropical Medicine and Hygiene, June 16, 1911.

during the period of suppuration there was absence of fever.

Another clinical feature frequently noted in these cases was the absence of the fetor which characterizes true variola during the period of suppuration. Bacteriological examination of pus removed from vesicles was made in eight cases. In seven the pus was found to be sterile, and in one case streptococci were found to be present.

Many cases similar to the one already mentioned were examined as regards absence of secondary fever.

Secondary fever did occur now and then, however, but it was exceptional, and had to be considered as an abnormal type, just as occasional aberrations as to temperature did occur in yellow and enteric fever.

Dr. Nilo Cairo, of Parana, informed Dr. Ribas that he had had some cases of a hæmorrhagic type. While admitting that a few such cases had occurred, as well as cases where secondary fever had developed, they were of such rarity as in no way to make him modify the description he had given as to the normal clinical features of the disease.

As a general rule it could be affirmed that, except in very rare cases of gravity, the patients felt quite well as soon as the eruption appeared, the reason for this being that it coincided with the disappearance of the fever, which had been marked during the period of invasion. Frequently, as soon as the eruption appeared, patients went on to their usual food and returned to their habitual occupations. Dr. Ribas once met a man on horseback, driving cattle, and observed that he had the vesicular eruption, already frankly purulent. He told Dr. Ribas that he had remained in bed for three days, during which time he had pains in his body and a sore throat, but as soon as the eruption appeared he felt well and resumed his usual work. On examination the lymphatics in the neck were swollen and painful to pressure, and the buccal mucous membrane was congested.

(4) *The Appearance of the Resulting Cicatrix.*—When cicatrices were left by the milk-pox, which was unusual, they presented an irregular and shallow depression, the margin also being irregular in outline.

(5) *The Mode of Action of Jennerian Vaccination.*—Vaccination was an excellent prophylactic measure against the spread of milk-pox, although the immunity conferred seems in some cases to be of shorter duration than was the case with regard to small-pox.

Vaccination on an extensive scale was carried out at Bello Monte do Pirajú, and both in the village and the farms the result was completely negative amongst those who had had alastrim, whilst in those who were unvaccinated, and had not had alastrim, vaccination gave positive results, with the exception of one case, in which the patient was vaccinated on the second day of the period of invasion of the disease, and in this case the disease was of the confluent type, and at the same time the vaccination vesicles became fully developed.

The same immunity to vaccination was observed in Avaré.

As the earliest cases in these two districts had been seen only from two to five months previously, Dr. Ribas sought out others where the attack was of older date. Thus, fifteen patients whose attack dated from six months back were vaccinated, and out of these in seven cases the result was frankly positive, giving a percentage of 46·6. This fact not only was strongly in favour of the differential diagnosis, but was of considerable importance from the point of view of the public health. For if these persons, six months only after recovery, showed such marked susceptibility to vaccination, it was reasonable to suppose that the immunity conferred by the disease was only of short duration. This was a point of importance in dealing with vaccination as a prophylactic measure against the spread of small-pox.

Rare cases, however, existed in which susceptibility to vaccination appears very much earlier.

Proceeding, Dr. Ribas said that these were five characteristics of this disease which helped in making a differential diagnosis between alastrim and true small-pox.

He then gave a clinical description of the disease, pointing out the most frequent symptoms present.

The eruption usually appears on the third day of the illness, first as a rash, which in a few hours becomes papular and vesicular. If the hand was passed over the surface at this stage there was a feeling as if there was small shot in the skin. On the fourth day of the eruption and seventh of the disease the vesicles became "pearly" in appearance, and immediately afterwards they became frankly pustular, especially on the face. A reddish areola surrounded the vesicles, but in severe cases this areola becomes more extensive. The vesicles then lost the pearly appearance and took on a more milky look, or, at times, that of white wax. On the fifth day of eruption and eighth of the disease the vesicles had become pustules. On the sixth day the pustules began to dry up and formed scabs; some, however, flattened out, and did not form scabs.

These scabs were formed in the following manner: A small point, at first the colour of yellow wax, which afterwards became darker, occupied the centre of each pustule. This point was the beginning of the change in the texture of the vesicular wall. There a small opening occurred, thus allowing the liquid contents to escape. This drying on the thin vesicular wall formed the scab. Dr. Ribas thought there was no true umbilication as in small-pox; that was to say, in milk-pox this appearance was only present when the above-mentioned change had taken place, which gave a pseudo-umbilication. In small-pox the true umbilication was due to the actual structure of the vesicles.

When the resulting scab fell off, in the form of a small dark-coloured scale, the underlying surface was seen to be slightly *elevated* compared with the surrounding skin. The colour was dark red, but this disappeared on pressure, and at the end of a certain time these maculæ disappeared altogether. Only in rare instances, and that where the disease had been of a confluent type, did the marks remain permanently.

The eruption also appeared on the mucous membrane of the mouth and other parts.

In cases of moderate intensity the duration of the disease might be put at fifteen days, but in severe confluent cases it might last twice this time. Confluence was most frequently observed on the face and lower limbs, rarely on the arms and trunk.

Alastrim had the same incubation period as small-pox, and during the period of invasion there was a rise in temperature till the appearance of the rash. The temperature might reach 40° C. to 41° C. The pulse-rate was in proportion to the temperature.

Other symptoms were sore throat, hoarseness, painful swelling of the cervical glands, injected conjunctivæ and coryza. Headache, backache and vomiting were also common symptoms, but the backache and vomiting were not so pronounced as in small-pox. Cases of greater severity occurred, and when suppuration was well marked there was subcutaneous œdema, especially of the face. If the eruption appeared on the palms of the hands and soles of the feet it was very painful. The urine was normal, and in the cases examined no albumin was ever found.

Taking into consideration all the points mentioned, he was forced to the conclusion that alastrim differed from all the eruptive fevers known in Brazil.

Its true nature and etiology could, however, only be determined by laboratory investigations.

Up to the present all attempts to prove that the disease was a modified form of small-pox had not been convincing.

### Discussion.

Drs. Daniels and Low, who discussed the paper, were both of the opinion that the disease that Dr. Ribas had described was identical with the mild cases of small-pox that existed in the West Indies in 1902 and 1904. The death-rate in these outbreaks was also very low, but even though this was so the diagnosis of small-pox was made. Osler states the same thing for the United States, recent epidemics there having been mistaken for chicken-pox and a belief even having become prevalent that a new disease had arisen, names such as Cuban or Philippine itch being given to it.

The starting point of the Barbados epidemic of 1901 was from a case in a white man who came from Halifax.

Though the mildness of all these types is remarkable yet they are only forms of small-pox and not a new disease as Dr. Ribas tries to make out.

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## EXTRACTS FROM THE SHANGHAI MUNICIPAL COUNCIL HEALTH DEPARTMENT ANNUAL REPORT, 1910.

By Arthur Stanley, M.D.
*Health Officer.*

In this very interesting report Dr. Stanley states amongst other things what has been done in the way of drainage, mosquito extermination, destruction of flies, &c. These are of great importance to all municipalities, and therefore the means employed may be given *in extenso*.

### "Drainage and Paving.

"It has been considered a duty in the ordinary course of sanitary inspection, not only to point out sanitary defects but also, when requested, to provide the means whereby these defects can be best remedied and to supervise the work to completion. In this way the native contractors have been taught the proper way of laying drains, forming cement channels, paving yards and other sanitary work.

"The defect usually met with, in the course of inspection, is that of blocked surface drains, due to absence of proper surface inlets. The use of gully traps with hinged grids with lineal openings is desirable, instead of the small circular openings at present so frequently used. Although the standard of drainage is improved, much is still required before the materials used are laid so as to obtain maximum self-cleansing and ability to stand the test of hard wear and tear. Much of the cement drainage material used by private contractors is of poor quality.

### "Creeks.

"Regarding these important natural tide-flushed drains, the object has been the abolition of stagnant water and the maintenance of tidal channels open, clean and clear. The flatness of the settlement necessitates the maintenance of certain waterways, and the Yangkingpang and Defence Creek, if properly maintained, are among them. The maintenance of the main artery creeks so as to permit of daily tidal flushing is a vital necessity. When a creek gets into such a condition that daily tidal flushing is not obtainable, its conversion into a covered sewer is, if it is in a residential district, generally desirable; but the filling in or culverting of creeks that are accessible to all tides is seldom advisable from a sanitary point of view.

### "Mosquito Extermination.

"A special staff was organized which worked from the early part of April until the end of October. The results are considered satisfactory, a diminution in the number of mosquitoes, estimated at from 25 per cent. to 75 per cent., having been effected. The work of the Chinese staff required very careful foreign supervision, as the results of good work were not directly apparent and the detection of bad work required assiduous care on the part of the foreign inspector.

"Co-operation was obtained from most foreigners but the majority of Chinese showed a complete indifference, amounting occasionally to active opposition. No prosecutions were undertaken to enforce these mosquito-extermination measures, but this would appear desirable in flagrant cases after repeated warning.

"A good class of coolie was obtained, paid at the rate of $10 monthly, and heavy fines inflicted on finding mosquito larvæ in places recently worked

through. The coolies worked in couples in an area exactly delimited. Each area was further sub-divided into seven for each day in the week and a time-table kept so that it could be known exactly where each mosquito couple was working at any time. The Assistant Inspector accompanied, and gave detailed instructions to each pair of coolies early in the season and made written notes of those unusual places where stagnant water was likely to be found, such as native gardens, empty houses, defective paving, gullies in unfrequented places, &c., *i.e.*, those places which were likely to be beyond a coolie's intelligence to think of, or beyond his courage to enter; these places subsequently received the special attention of the Assistant Inspector. Practical roadside demonstrations were given of the way mosquitoes develop and how to prevent them developing by getting rid of all collections of stagnant water.

"The thicker oils, containing a large proportion of crude petroleum, were not found to form good spreading films even in the hottest weather—equal parts of kerosene and crude oil was found of most value.

"MOSQUITO NOTICE.

"*No Stagnant Water—No Mosquitoes.*

"Mosquitoes carry *malaria* and other diseases.

"Mosquitoes cannot multiply except in *stagnant water*. Where stagnant water cannot be *abolished* the use of kerosene sprinkled on the surface so as to to form a film will kill mosquito 'wrigglers,' as it prevents them breathing when they come to the surface.

"Old tins and bottles, broken crockery, flower-pots and unconsidered *articles of this kind capable of holding rain-water* should be carefully *collected* from the garden and backyard and placed in the house refuse receptacle for removal.

"Tubs, kongs, water plants, flower-pots, saucers or other *vessels of water* which cannot be dispensed with should be *emptied or sprinkled with kerosine once a week.*

"*Gardeners' kongs, dug-outs, wells and water barrels* should be done away with, water for the garden, &c., being derived directly from the tap or, if that be impossible, the kongs, &c., should be oiled once a week or kept securely covered so that mosquitoes cannot get to the water to lay their eggs.

"Have the water from kennels, chicken coups, &c., regularly emptied out.

"Keep drains and rain-water roof channels clean and clear and in good repair. *Gully traps* that are not frequently flushed should be oiled weekly.

"Shallow *rain-water pools and slushy places* can generally be obliterated by a *scratch drain, or levelled* with house ashes, *ponds and ditches* by *filling in* with house refuse covered with a little earth or ashes.

"*Ornamental ponds* may be kept free from mosquitoes by *small fish* but, if mosquito 'wrigglers' be found, the water should be *oiled weekly* preparatory to *filling in.*

"A *weekly inspection* of house and surroundings should be made. It may be remembered that a small unheeded pot of water will suffice to breed sufficient mosquitoes to irritate a whole neighbourhood.

"FLIES.

"Against what has been truly described as 'the deadly house-fly' the careful collection and disposal of house refuse is a measure of primary importance. Among other public measures has been the requirement as one of the conditions of licence, in premises licensed for the purpose of safeguarding the food supply, of adequate means being taken to prevent the access of flies to food-stuffs by the use of perforated zinc in windows and spring doors. This screening against flies is also an important individual measure and should be applied to the serving room, kitchen and servants' latrine; while cleanliness should be maintained in and about the house, so as to deprive the insect of food and of breeding-places."

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## NOTES FROM THE ENTOMOLOGICAL DEPARTMENT OF THE LONDON SCHOOL OF TROPICAL MEDICINE. — NO. II. DESCRIPTION OF A NEW SPECIES OF *SIMULIUM* FROM THE SIAMESE HILLS.

By Miss SOPHIA L. M. SUMMERS, M.A., B.Sc.

*Simulium nigrogilvum*, sp. n.

NUMEROUS specimens of this fly were sent, very kindly, to the London School of Tropical Medicine by Dr. Kerr, of Chiengmai. They were collected by Mr. H. B. G. Garrett, of the Siamese Forest Department, on the hills of Siam east of the Menam, during the months of September and October.

In view of Dr. Sambon's theory, that *Simulium* plays an important part in the spreading of pellagra, every reference to this genus is of interest. Only two species of the genus as yet have been described from the Oriental Region, namely, *Simulium indicum*, Becher, from the Himalayas [*Journ. Asiat. Soc. Bengal*, liii., pt. 2 (1884), p. 199, pl. xiv.], and *S. nobile*, Meijere, from Java [*Tijdschrift voor Ent.* Deel l. (1907), p. 206.]

The new form, *S. nigrogilvum*, is a very striking species. Its colouring is most vivid, almost wasp-like in its contrasts. It is large, its length being almost 3·5 mm. Its head and thorax are velvety black, with bright golden hairs. The antennæ are brown, yellowish white at the base. In spirit the abdomen is white, with brown bands posteriorly. The legs are banded black and white; the tarsi of the front pair are much stronger than those of the other pairs. The wings are hyaline.

*Head* velvety black, with golden hairs between and behind the eyes; the face also is black. *Antennæ* dark brown, except the first two segments and a part of the third, which are yellowish-white. *Palps* brown, with the exception of the second segment, which is black.

*Thorax* velvety black; the scutum is covered more or less with bright golden hairs.

*Wings* hyaline, with only the first and third longitudinal veins distinct and dark. *Halteres* yellowish-white.

*Legs.*—Femora and tibiæ are white at the proximal end, dark brown at the distal end. All the tarsal segments of the first pair of legs are dark brown, but in the second and third pairs the metatarsus is yellowish-white in the proximal half, and the next tarsal segment has a white spot at the base. The penultimate tarsal segment is heart-shaped in all the legs.

*Abdomen.*—In spirit-specimens the first two segments are white: the third, fourth, and fifth are white, each with a dark brown dorsal cross-band; the last two are entirely brown, darker dorsally than ventrally.

The mouth-parts seem to be similar to those of other species. The second segment of the maxillary palps has a curious little, probably sensory, vesicle, with a minute circular opening on the side of the segment.

*S. nigrogilvum* is about the same size as *S. indicum*, but it differs from that species in the following points: (1) The base of the antenna is yellowish-white, whereas in *S. indicum* the antennæ are entirely dark; (2) the femora and tibiæ are half white, half black, but in *S. indicum* they are said to be black-brown; (3) the first two segments of the abdomen are white, and ventrally all the rest of the abdomen except the tip is white also, whereas in *S. indicum* only the first segment and the sternal parts of the next three segments are yellowish-white.

*S. nigrogilvum* is much larger than *S. nobile*, which measures only 1·5 mm. The other points of difference between the two species are as follows: (1) The antennæ of *S. nobile* are reddish-yellow, with black tip; (2) the thorax of *S. nobile* is said to be almost naked, with a silver-white sheen, only a posterior strongly arched cross-band being velvety black, whereas in *S. nigrogilvum* the scutum is covered with bright golden hairs. In *S. nobile* the legs are described as blackish-brown, the hind tibiæ as shiny mother-of-pearl, the basal moiety of the first two tarsal segments of the same leg as yellow; but in *S. nigrogilvum* the legs are banded black and white. The halteres are reddish-yellow in *S. nobile*, but in the new species they are white. The abdomen of *S. nobile* is silky black, instead of being, as in *S. nigrogilvum*, largely yellowish-white.

The type of the new species has been presented to the British Museum. Unfortunately, having been dried after being in spirit, its colouring is affected.

I wish to take this opportunity of thanking Lieutenant-Colonel Alcock, I.M.S., F.R.S., C.I.E., &c., for his constant help and advice, which are invaluable.

—From the *Annals and Magazine of Natural History*, Series 8, vol. vii., June, 1911).

## Annotations.

*Blackwater Fever.*—Deeks and James publish a very interesting and comprehensive study of blackwater or hæmoglobinuric fever in the Isthmian Canal Zone. Their report is published by the Department of Sanitation of the Isthmian Canal Commission and is well worth reading. Several theories prevail at present as to the cause of this malady, and any further work on the subject may always throw some light on places that are dark. The conclusions of these two authors —which may be given *in extenso*—are as follows:—

"The history of hæmoglobinuric fever proves that the symptomatology of the disease was recognized and recorded prior to the time when the malady was distinguished either as an entity or as a symptom-complex of malaria. There is no proof that blackwater fever has spread from one country to another, or from one part of a country or another, as have kala-azar, yellow fever and sleeping sickness. On the contrary, the disease invariably manifests itself when certain conditions relative to the epidemiology of malaria, and to that of no other disease, are present. These conditions are:—

"(1) The presence of a population non-immune against malaria.

"(2) The prevalence of malaria in such quantity as to produce an almost continuous infection in this population.

"(3) A large proportion of æstivo-autumnal malaria; because the amount of blackwater fever is in direct proportion to the intensity of this variety.

"(4) The neglect of prompt and continued administration of quinine, especially in primary attacks, to persons non-immune against malaria.

"In every locality, without exception, where these conditions obtain, hæmoglobinuric fever is found.

"The conditions may vary from time to time in the same or in different localities, with a corresponding increase or decrease in the amount of the hæmoglobinuric fever. They are present in restricted areas and absent from those contiguous. When any condition varies, hæmoglobinuric fever varies in proportion. In this respect the malady differs from every infectious disease other than malaria, for it does not enter a hitherto non-malarial district except by the introduction of æstivo-autumnal malaria; when this malaria becomes prevalent in a region formerly free, blackwater fever follows in proportion to the intensity of malaria, and the capacity of the population to acquire immunity. Also, æstivo-autumnal malaria may obtain very extensively among children when in places where the adult population, by reason of continued attacks in childhood, has acquired immunity. If non-immunes do not enter such places, or if, after entrance, prompt prophylactic and therapeutical measures are instituted against malaria, blackwater fever does not prevail."

The authors believe that these propositions are supported by positive evidence, and do not admit of controversy. Every statement made in support of them has concrete facts and the witness of authori-

tative observers as its basis. The conditions necessary they think for the generation of hæmoglobinuric fever explain clearly why the disease is absent from places where it once prevailed, or is present in those from which it was formerly absent; why it occurs in some malarious countries and not in others; why it obtains in certain areas only in a malaria-infected district; and why in restricted localities, or even in certain houses, the malady may present itself, while those adjacent are free.

"Although the evidence associating hæmoglobinuric fever with the presence of malarial parasites is circumstantial, since it relies in great part on the skill and experience of observers, it is none the less strong and authoritative, in actuality far more so than that which implies a lack of such association. Notwithstanding the reported absence in isolated instances of proof of malarial infection in blackwater fever during life or at autopsy, the connection between the two is not materially affected thereby; for when all circumstances of the relationship are considered in their entirety, the dependency of the latter upon the former is manifested to an extent unparalleled in the etiology of infectious diseases. When to the epidemiological evidence of this relationship is added these proofs: that in no other malady is malarial infection so constantly present; that in malarious countries other diseases fail to show even an approximate amount of such infection; that mechanical and therapeutical measures instituted against malaria are equally efficient against hæmoglobinuric fever; that prompt and efficient treatment against the one, no matter how greatly it obtains, is successful also in reducing the prevalence of the other; either the truth of the relationship as asserted must be admitted, or the existence of an organism dependent upon the conditions enumerated must be assumed. Such an assumption is not supported in biology, either by analogy or fact, unless some vague conjecture of an improbable symbiosis be so included."

Throughout their report the authors have referred to hæmoglobinuric fever as a disease, or else have used a synonymous term. They have done this, partly in deference to the present custom, and partly to avoid ambiguity. In their opinion it is better to describe hæmoglobinuric fever, as Marchiafava and Bignami have done, as "a syndrome which is encountered not rarely, especially in hot climates, in the course of a malarial infection." For, although medical usage may sanction in some instances the classification of different conditions dependent upon the same etiological factor as distinctive "diseases," there is no need for such application to the description of the hæmoglobinuria and associated symptoms that "occur in the course of a malarial infection."

Unlike some writers, Deeks and James, do not find difficulty in calling blackwater fever a syndrome. They consider that it is necessary to assume that all malarial infections of a certain intensity are followed by hæmoglobinuria; because, for such determination an individual predisposition is necessary. In most cases, but not in all, this predisposition is enhanced by repeated attacks of malaria. That is why regions of the most intense malaria produce the most blackwater fever; for the chances of very susceptible persons becoming infected with malaria are thereby made certainties, while the likelihood of determining a predisposition in less susceptible persons is correspondingly increased. Except in localities where malarial infection and repeated re-infection and relapses are continuous, hæmoglobinuric fever is comparatively rare, but it is not more uncommon than are the comatose and algid types of malaria, or any one of the syndromes depending upon interference with the functioning of the nervous system, such as a paralysis or a neuritis. These, like hæmoglobinuric fever, may occur at any time in the course of a malarial infection, especially in an untreated or improperly treated one, and do occur most often where malaria is most intense. Since it is not possible to predicate the amount of infection that results in the determination of any of these other malarial syndromes, otherwise than to say that they occur in proportion to the intensity of malaria, they believe it is illogical to assert, as some have done, that blackwater fever should invariably follow when a certain degree of personal malarial infection has been attained. One might as well say that every infection with *Bacillus tuberculosis* is followed by the same symptoms; or that meningitis ensues when a certain number of the diplococci of pneumonia are present.

When such organisms localize in certain parts of the body, definite symptoms follow, and under certain conditions the authors think the toxins of malarial poison produce hæmolysis; but why some persons are thus acted upon while others with equal amounts of infection are not, is a problem that still awaits solution, nor does a lack of knowledge in this respect affect the cognizance of the primary cause.

Finally, Deeks and James state, that in their opinion, "the primary cause in hæmoglobinuric fever, is either prior or coincident malaria, or both, the immediate cause being sometimes the administration of quinine, but this never acts unless the primary cause has been, or is present." With this knowledge they believe that the syndrome may be treated intelligently, and its occurrence often may be prevented by the removal of the primary cause; and by sending away from the source of infection those who, by reason of personal idiosyncrasy cannot take quinine at any time without the production of blackwater fever.

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*Strongyloides Infections in Man.*—Darling, in the *Journal of Experimental Medicine* for July 1, 1911, after a study of strongyloides infections in man and animals in the Isthmian Canal Zone, concludes that it has been determined, in confirmation of the view of Grassi, Calmette, and others, that they are not causative factors in the production of diarrhœa. The mother worm, however, burrows into the mucosa and deposits her ova there. Certain tissue reactions take place and are evidenced by the cellular proliferation in those portions of the intestines occupied by the nematodes.

In animals there is an associated anæmia, not positively attributable to the strongyloides, but, on the other hand, not attributable to any other cause. It is possible that *S. stercoralis* may cause some degree of anæmia in man. The amount, he believes, however, is indeterminable in the Isthmian Canal Zone among hospital cases on account of the associated hook-worm disease or malaria.

Portals of entry for various micro-organisms can, however, be made by the female mother worm and her larvæ in the small intestine, and, though no case of general bacterial infection has been proved to have arisen in this way, its occurrence is possible and highly probable.

In the cultures of strongyloides of man, Darling has found among natives, who presumably are infected with purely tropical strains, a very marked predominance of development by the indirect or sexually differentiated mode, in some cases, an absolutely pure culture of the indirect mode larvæ having been obtained. There were, however, natives, cultures from whose stools contained from a single filariform larva of the direct phase up to a very definite predominance of this mode. Cultures from natives of the temperate zones contained a marked predominance of the direct phase larvæ.

The presence of the filariform (direct mode) larva, Stiles believes is best accounted for by its being an attempt at more perfect parasitism.

From a correlation of culture study with the results of a histological examination of the invaded mucosa, Darling believes that this explanation of the derivation of the two phases is suggested. The mother worm in the intestinal tract has two kinds of progeny: (*a*) those expelled into the crypts or lumen, and (*b*) those embedded in the intestinal wall. One lot becomes larvæ of either the direct or indirect phase; the other lot of the opposite phase. It appears that the intra-epithelial cell-developed larvæ furnish the direct phase, while the embryos expelled directly from the mother become the indirect phase larvæ.

This, he believes, requires for its confirmation a study of cultures in connection with a histological examination of the infected intestinal wall.

Cold merely inhibits the development of the larvæ into either the filariform (direct) or into the sexually differentiated adults, and does not alter the anlage.

The resistant as well as the infecting form is the filariform larva, and all chemical larvicides must be directed against this form. Thymol and an alkaline cresol resin soap Darling found to be effective larvicides for the filariform larvæ.

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*The Treatment of Ascaris Lumbricoides Infections.* Preston Maxwell, in the *China Medical Journal* for May, 1911, recommends the following treatment for the expulsion of round worms:—

"There is only one treatment for *Ascaris lumbricoides*, and that is santonin.

"The best method is a dose of castor oil with 4-5 gr. of santonin suspended in it for an adult, and the same drug in a smaller dose for children, followed up by systematic dosing with a powder of hydrarg c. creta and santonin, or calomel and santonin. The writer prefers the former powder, and gives it to adults in doses of a grain of each twice a day till all evidence of infection has disappeared.

"When one is satisfied that the worms are dislodged, a course of iron and nourishing diet, especially in the case of children, rapidly sets the patient on his feet.

"White or yellow santonin may be used. The writer's (Dr. Maxwell) impression is that the latter is the more efficacious, but intoxication symptoms are oftener seen when it is used. He has seen an adult patient quite dazed, and with hallucinations, a few hours after a dose of 6 gr. and in some cases it will produce a transient but alarming delirium.

"It is not uncommon for the first few doses of a course of santonin to make a patient feel very wretched, both from the stirring up of the worms and the influence of the santonin, but tolerance is rapidly established. A patient should be warned as to the possibility both of feeling wretched and of zanthopsia.

"Occasionally a sharp attack of vomiting will follow a dose of santonin, but this is very rare, and in the only case Dr. Maxwell met small doses of thymol proved an effectual substitute.

"In some cases the disturbance of the worms will set up a smart attack of fever, especially in those who already harbour the malarial parasite. But in other cases it is independent of malarial fever, and is due to some unknown cause, possibly absorption of some toxin from the bowel.

"In the case of children, even if ova are not found in the stool, if worms are suspected from other symptoms, it is well to give a few doses of santonin. No other method of treatment is mentioned, for this method is sure and simple. The treatment of complications has to be carried out on general principles."

## Drugs and Appliances.

GLAXO, a soluble desiccated preparation of milk, is coming more into favour with the medical profession and the laity as its usefulness becomes apparent. For infants deprived of their natural nourishment, it is especially in favour, and experience shows that the belief in its value is amply justified. One need have no hesitation in recommending Glaxo. In hot weather and in the Tropics milk cannot be kept without manipulation or the addition of preservatives of some sort, but the desiccation of milk removes this necessity and allows of the possibility of obtaining milk in a condition which is as near the natural state as it is possible to conceive. Brand and Co., South Lambeth Road, Vauxhall, London, S.W., are the British Agents for "Glaxo."

BURROUGHS WELLCOME AND CO.—"*Bivo*" *Beef and Iron Wine* serves well as a tonic during convalescence, it is pleasant, easily digested and assimilated.

"*Wyeth Beef Juice*" is the concentrated juice of

beef expressed in the cold. This fact distinguishes the preparation from beef tea and meat extract in which heat plays a part and probably a detrimental part. It is taken also in cold water, a fact that renders it available under all circumstances.

"*Nizin*" (soloid) a zinc salt of sulphanilic acid in quantities of 2 gr. is a non-irritating and antiseptic injection in gonorrhœa and useful in gonorrhœal ophthalmia.

LYSOFORM.—In a circular issued by Thomas Christy and Co., Old Swan Lane, London, E.C., testimony is given by many competent authorities in many countries, as to the efficiency of Lysoform. The various opinions may be summed up in the pronouncement that Lysoform is the antiseptic which unites the maximum of bactericidal power with the minimum of toxicity.

KEROL DISINFECTANT PREPARATIONS (Quibell Bros., Ltd., Newark, England) consist of fluids, powders, soaps, &c., having for their active principle an oxygenated diphenyl compound practically non-poisonous and non-irritant. The efficiency of the preparations seems undoubted and they possess an odour which is by no means unpleasant. Kerol is stated by Professor Tanner Hewlett to possess practically the same efficiency as Cyllin, a high commendation.

ROBOLEINE, a preparation of fresh red bone marrow, the expressed juice of calves' rib-bones, cream of malt and hypophosphites of lime, soda and potash, prepared by Messrs. Oppenheimer, Son and Co., 179, Queen Victoria Street, London, E.C., is a valuable preparation in all cases of debility and during convalescence. Patients who cannot take cod liver oil enjoy the Roboleine. In summer in temperate countries and in the Tropics, at all times, Roboleine can be given as a substitute for cod liver oil with benefit.

THROAT PASTILLES.—Medication by way of lozenges, jujubes, &c., in the case of mouth, throat, and laryngeal affections has never been taken seriously by the medical profession, and there is reason for the hesitation in doing so. Recently, Messrs. Allen and Hanburys, Plough Court, Lombard Street, London, have taken up the question and devoted considerable attention to the matter. The "Allenbury Pastilles" are a distinct advance in medicaments for affections of the mouth and throat, and contain drugs in combination which are well chosen and presented in a form at once agreeable and calculated to prove efficient. We would especially direct attention to the pastilles termed "Camphorated Voice" "Menthol, Eucalyptus and Red Gum," "Chloride of Ammonium," "Compound Guaiacum," "Antiseptic Liquorice" and "Formaldehyde and Menthol." These are mentioned from a list of no less than seventy-seven pastilles enumerated, and the practitioner must be difficult to please if he cannot select from amongst them one suitable to the many ailments which attack the mouth, throat and larynx.

# Recent and Current Literature.

*A list of recent publications and articles bearing on tropical diseases is given below. To readers interested in any branch of tropical literature mentioned in these lists the Editors of the* JOURNAL OF TROPICAL MEDICINE AND HYGIENE *will be pleased, when possible, to send, on application, the medical journals in which the articles appear.*

### "Indian Medical Gazette," June, 1911.

*Cysticercus Cellulosæ Infection in Man.*—Tirumwiti describes a case of *Cysticercus cellulosæ* infection of the brain of a native in Madras. He states that only three cases of this somewhat rare condition have been recorded in India before this. Clinically the patient had signs of hemiplegia—a diagnosis of this condition being made. Ten days after admission the patient became unconscious, and a few days later symptoms of meningitis appeared. He died in this condition. At the autopsy numerous cysts were found scattered through the muscles of the body, and also throughout the brain substance, mostly situated immediately beneath or in the grey matter of the cortex. Microscopic examination showed the cysts to be those of *Tænia solium*, *e.g.*, the *Cysticercus cellulosæ*.

### "Lancet," July 8, 1911.

*Malta Fever.*—In an annotation in the above number of the *Lancet*, p. 105, it is stated that the Governor of Malta has made representations to the Secretary of State for the Colonies asking that the name Malta fever should be deleted from medical nomenclature as the name as it exists is disadvantageous to that island. As is pointed out, the fever is not confined to Malta. The Governor's views were brought by the Secretary of State before the notice of the London and Liverpool Schools of Tropical Medicine, the War Office, the Admiralty, and also before the Academy of Medicine in France. As a result all these institutions have agreed to abandon the use of the term Malta fever, but it is not stated what other term has been substituted in its stead. Probably undulant fever would be the best term.

### "Journal of the Royal Army Medical Corps," No. 1, July, 1911, vol. xvii.

*The Life-history of the Phlebotomus*—Captain Marett gives a very good account of the life-history of the *Phlebotomus*, his work having been carried out in Malta. According to Dr. Newstead, of the Liverpool School of Tropical Medicine, three species of *Phlebotomus* are found in Malta, *e.g.*, *P. minutus*, *P. molestus*, and *P. papatasii*. Captain Marett suggests some interesting measures for the prevention of the breeding of these flies, which, if found practical, should lower the incidence of "sand-fly" fever.

# Personal Notes.

COLONIAL MEDICAL SERVICES.

*West African Medical Staff.*

*No deaths.*

*No resignations.*

*Retirements.*—W. J. B. Carter, M.R.C.S.Eng., L.R.C.P. Lond., Medical Officer, Gold Coast; W. H. W. Strachan, C.M.G., M.R.C.S.Eng., L.R.C.P.Lond., Principal Medical Officer of Southern Nigeria, retires on pension; S. W. Thompstone, C.M.G., F.R.C.S., F.R.C.P.Edin., L.F.P.S.Glas., D.P.H.Cantab., Principal Medical Officer of Northern Nigeria, retires on pension.

*Promotion.*—W. H. Langley, C.M.G., F.R.C.S., L.R.C.P. Ireland, Principal Medical Officer of the Gold Coast, to be Principal Medical Officer of Southern Nigeria.

*New appointment.*—W. M. Woods, L.R.C.S., L.R.C.P., L.M.Ireland, D.T.M.L'pool, has been selected for appointment as a Medical Officer in Southern Nigeria.

*Other Colonies and Protectorates.*

Miss C. E. Anderson, M.B., Ch.B.Aberdeen, L.M.Ireland, D.T.M.L'pool, has been selected for appointment as Medical Officer in charge of the Lady Havelock Hospital for Women and Children, Colombo, Ceylon; R. P. Cockin, M.B., B.C.Cantab., District Medical Officer, Nicosia, Cyprus, has been selected for appointment as Resident Surgeon of the Colony Hospital and Bacteriologist, Grenada, West Indies.

Dr. S. V. Van Niekerk, Medical Inspector of Mines for the Transvaal, has become Medical Officer to carry out in the Labour Districts of the Transvaal the regulations framed under the Coloured Labourers' Health Regulations Ordinance.

Dr. A. J. G. Barker, Principal Medical Officer in the Sarawak Service, has retired on pension owing to ill-health. He entered the Service as Colonial Surgeon, Penang, in 1895, and became Principal Medical Officer in Sarawak two years later.

INDIA OFFICE.

*From June 3 to July 3.*

*Arrivals reported in London.*—Captain D. H. Rai, I.M.S.; Captain E. A. St. Romaine, I.S.M.D.; Major P. St. C. More, I.M.S., B.; Captain W. Lapsley, I.M.S., B.; Captain T. G. N. Stokes, I.M.S., B.; Captain D. G. Rai, I.M.S., M.; Captain T. S. B. Williams, I.M.S., Bo.; Surgeon-General H. W. Stevenson, I.M.S.; Colonel T. Grainger, I.M.S.; Major F. E. Swinton, I.M.S.; Captain H. Melhuish, I.M.S.; Captain E. B. Monro, I.M.S.; Lieutenant-Colonel C. H. L. Meyer, I.M.S., Bo.

*Extensions of Leave.*—Captain D. N. Anderson, I.M.S., 4 months; Captain R. G. G. Croly, I.M.S., 4 months M.C.; Captain W. E. Brierley, I.M.S., 6 weeks on M.C.; Captain J. E. Clements, I.M.S., B., 3 days; Major E. C. G. Maddock, I.M.S., B., 6 weeks on M.C.

*Permitted to Return.*—Major E. C. G. Maddock, I.M.S., Bo.

LIST OF INDIAN MILITARY OFFICERS ON LEAVE.

*Showing the Name, Regiment, or Department, and the Period for which the Leave was granted.*

Bensow, Surgeon-General R. H., C.B., I.M.S.
Boalth, Captain W. H., I.M.S., 8 m., from May 13, 1911.
Brierley, Captain W. E., I.M.S., 7½ m., from March 7, 1911.
Grainger, Colonel T., I.M.S.
Ker, Lieutenant-Colonel M. V., I.M.S.
Melhuish, Captain H. M. H., I.M.S.
Munro, Captain E. B., I.M.S.
Rai, Captain D. H., I.M.S., 12 m., from April 25, 1911
Stevenson, Surgeon-General H. W., I.M.S.
St. Romaine, Captain E. A., I.S.M.D., 6 m., from May 7, 1911.
Swinton, Major F. E., I.M.S.
Wernicke, Captain F. P., I.M.S., 8 m., from March 21, 1911.
Whitamore, Captain V. N., I.M.S., 1 year, from May 5, 1911.

LIST OF INDIAN CIVIL OFFICERS ON LEAVE (INCLUDING MILITARY OFFICERS UNDER CIVIL RULES).

*Showing the Name, Province, and Department, and the Period for, and Date from, which the Leave was granted.*

Foulkes, Major T. H., I.M.S.
Hunt, Major S., I.M.S., India Foreign, 19 m. 6 d., April 9, 1910.
Hunter, Major G. Y. C., I.M.S., B. Gaols, 18 m., March 30. 1911.
Hynes, Captain G., I.S.M.D., U.P., 18 m., April 16, 1910.
Illius, Captain H. W., I.M.S., U.P., 12 m., March 14, 1911.
Jennings, Lieutenant-Colonel W. E., I.M.S., Bo., 8 m., January 28, 1910.
Kilkelly, Major P. P., I.M.S., Bo., 24 m., March 13, 1911.
L. Said uz-Kafar Khan, I.S.M.D., U.P.
Lamb, Major G., I.M.S., 29 m., May 27, 1909.
Lane, Major C. A., I.M.S., B., 22 m. 2 d., December 28, 1909.
Lapsley, Captain W., I.M.S., U.P.
Leicester, Major J. C. H., I.M.S., B., 24 m., November 8, 1910.
Little, Captain J. W., I.M.S., N.-W.F. Prov., 17 m., May 10. 1910.
Lumsden, Lieutenant-Colonel P. J., I.M.S., Res. Surgeon, Hyderabad, 8 m.
McPherson, Captain J., I.M.S., Res. Surgeon, Turkish Arabia.
Macrae, Major J. L., I.M.S., India Foreign, 8 m., February 2, 1911.
Mactaggart, Lieutenant-Colonel the Hon. C., I.M.S., Insp.-Gen. of Prisons, U.P., 20 m., March 1, 1911.
MacWatt, Lieutenant-Colonel R. C., I.M.S., India Foreign, 24 m., Nov. 4, 1910.
Maddock, Captain E. C. G., I.M.S., Bo., 18 m., March 20, 1910.
Maddox, Major R. H., I.M.S., B., 10 m., January 14, 1911.
McCay, Major D., I.M.S., B., 15 m., July 1, 1910.
McCoy, Captain J. W., I.M.S., E.B. and A., 20 m., March 16, 1910.
Miller, Major A., I.M.S.M., 18 m., December 19, 1910.
Milne, Major C., I.M.S., U.P., 17 m., April 19, 1910.
More, Major P. St. C., I.M.S., Punjab, 20 m., April 29, 1911.
Mulvany, Major J., I.M.S, B. Gaols, 20 m., March 11, 1910.
Munro, Captain D., I.M.S., B., 12 m., December 1, 1910.
Murray, Major J. H., I.M.S., Port Blair., 24 m., July 30, 1910.
Nott, Lieutenant-Colonel A. H., I.M.S., B., 6 m., April 18, 1911.
Oxley, Captain J. C. S., I.M.S., C.P., 20 m. 20 d., October 29, 1910.
Pearson, Captain W. M., I.M.S., U.P., Med. Dept., 18 m., March 16, 1910.
Peck, Major E. S., I.M.S.
Penny, Major J., I.M.S., Burma, 20 m., Febuary 21, 1910.
Pisani, Lieutenant-Colonel L. I., I.M.S., U.P., 21 m., September 10, 1909.
Pratt, Lieutenant-Colonel J. J., I.M.S., U.P., 18 m., November 16, 1910.
Quicke, Lieutenant-Colonel W. H., I.M.S., Bo., 16 m. 7 d., December 18, 1909.
Rai, Captain D. G., I.M.S., M., 15 m., March 21, 1911.
Rait, Major J. W. F., I.M.S., B., 14 m., September 20, 1910.
Ritchie, Captain W. D., I.M.S., E.B. and Assam, 24 m., December 26, 1909.
S. Said uz-Kafar Kahan, I.S.M.D., U.P.
Southon, Captain C. E., I.M.S., 21 m., May 12, 1910.
Sprawson, Captain C. A., I.M.S., U.P., 15 m. 3 d., April 14, 1910.
Steen, Captain R., I.M.S., U.P., 12 m., October 13, 1910.
Stephen, Captain L. P., I.M.S., Bo., 16 m., November 4, 1910.
Stokes, Captain T. G. N., I.M.S., C.P., 6 m., May 6, 1911.
Swan, Captain J. G. G., I.M.S., Punj., 24 m., November 9, 1909.
Sykes, Lieutenant-Colonel W. A., D.S.O., I.M.S., Beloochistan, 19 m. 1 d., December 16, 1910.
Tucker, Captain W. H., I.M.S., M., 19 m., April 10, 1910.
Turner, Major R. G., I.M.S., U.P.
Vaughan, Lieutenant-Colonel J. C. S., I.M.S., Bengal, 24 m., October 31, 1909.
Watson, Major T. E., I.M.S., 24 m., December 3, 1909.
Watts, Captain H., I.M.S., Punj., 12 m., September 22, 1910.
Wells, Captain N. S., I.M.S., U.P., 12 m., May 13, 1910.
Williams, Captain H. A., D.S.O., I.M.S., 24 m., February 18, 1911.
Williams, Captain T. S. B., I.M.S.
Williams, Major C. E., I.M.S., Burma, 15 m., May 19, 1910.

## Notices to Correspondents.

1.—Manuscripts sent in cannot be returned.

2.—As our contributors are for the most part resident abroad, proofs will not be submitted to those dwelling outside the United Kingdom, unless specially desired and arranged for.

3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.

4.—Authors desiring reprints of their communications to the JOURNAL OF TROPICAL MEDICINE AND HYGIENE should communicate with the Publishers.

5.—Correspondents should look for replies under the heading "Answers to Correspondents."

## Original Communications.

# THE MODE OF TRANSMISSION OF LEPROSY.

By T. Lindsay Sandes, M.A., M.D.
*Research Medical Officer, Robben Island Leper Asylum, South Africa.*

The mode of transmission of leprosy from the infected to the healthy is a question which has hitherto baffled research. Of the infectivity of the disease no one who has studied its history and has carefully investigated any considerable number of cases, their previous life and social relations, and who considers the evidence without prejudice, can, I think, have any doubt.

In the first place, a word as to heredity. It is exceedingly improbable that an ovum, still less a sperm cell, could contain so relatively large an intruder as a lepra bacillus and yet suffer so little derangement of its great but excessively delicate potentialities as to render successful fertilization and development possible. This view was first enunciated by Virchow in discussing the germinative transmission of tuberculosis, and it has never been adequately refuted. We are aware that the infections of pebrine, a disease of silkworms, and of syphilis, are capable of being deposited previous to fertilization in the parental elements, but in both these cases the progeny, mature or otherwise, show widespread infection and the diffuse ravages of the particular disease immediately, or more usually shortly after birth. I have had the opportunity on two occasions of examining the tissues of the offspring of leper parents which were either stillborn or had died soon after birth; in neither of them was the lepra bacillus or anything suggestive of its presence discoverable. In well-marked cases of tubercular leprosy bacilli may be demonstrated in the ovaries, prostate, seminal fluid and elsewhere in the genital tracts, but careful and repeated search has failed to discover the organism in either the sperm or germ elements. This, of course, is negative evidence, nevertheless it is not entirely valueless. Placental transmission, unless as an accident, also seems highly improbable. The bacilli are at any time very difficult of demonstration in the blood. During acute exacerbations of the disease with the formation of fresh tubercles, fever, sickness, and other signs of general infection, they are not so difficult to find. But pregnant females, in my experience at any rate, are remarkably free from these superimposed attacks of acute leprosy, however much they may relapse afterwards. Microscopic examinations of placentæ have shown no bacilli nor lesion attributable to their previous presence.

Children are undoubtedly more susceptible to infection than adults, and as a rule the disease makes rapid and destructive progress in their young tissues. Infection, however, takes place not only by reason of an increased susceptibility in their junior years, but also on account of the unlimited opportunities afforded for its transmission during the early period of dependence and intimate contact of parent and offspring.

Commensal feeding and the fact that the bacillus flourishes in the products of tryptic digestion suggest the possibility of a primary alimentary infection; the bacilli, perhaps, after ingestion, reach the small intestine and find a suitable medium whence they subsequently make their way into the general circulation and so establish the disease. But considering the delicacy of the lepra organism in its initial stages of artificial growth, the adverse conditions it is likely to meet in the gastric and intestinal tracts, the absence, so far as my inquiries have gone, of an early clinical history in consonance with such an infection and the negative results of *post-mortem* examinations of early cases of the disease as regards involvement of the intestinal tract and mesenteric lymphatics, it seems to me that this mode of transmission of the infection, if it does occur, must be rare.

Inhalation of dried bacilli floating as dust may also be suggested as a probable path of infection. Ulceration, with dense bacillary infiltration of the nasal mucous membrane, is the rule in tubercular leprosy. But again, although an early lesion, it is not initial; in fact, it is not observed until the general infection is distinctly pronounced. Infiltration, nodule formation and ulceration of the larynx and adjacent mucous membranes are very frequent, but only as late, or sub-terminal, complications in tubercular leprosy.

Leprotic involvement of the lungs is very uncommon. Clinically I have never known it, and in my last 50 *post-mortem* examinations microscopic inspection has always failed to discover undoubted lepra bacilli or granulomatous reaction due to their presence, although the tubercle bacillus and the results of its presence were very frequently observed.

In brief, then, we have no reason to believe that the infection of leprosy is transmitted *ante-partum*, and both the mode and the site of primary infection have hitherto remained undiscovered.

As a result of observations on a large number of cases of leprosy, I was led to direct increasing attention to the skin as the probable site of primary inoculation. Over a year ago, therefore, I decided to conduct my researches in this matter with a view to establishing or eliminating any *rôle* the commoner and more widely distributed domestic insects might play. I considered the common house-fly (*Musca domestica*). The genus *Stomoxys*, and the *Hæmatobia irritans*, or horse-fly, are vicious biters and, on *a priori* grounds, more probable carriers of infection, though the latter rarely bites man, but they are uncommon on this island and I determined to work, in the first place, with the more abundant material at hand. Further, I examined the common flea (*Pulex irritans*), also the local varieties of mosquito (*Culex* and *Anopheles*), and finally the bed-bug (*Acanthia lectularia*). My methods were simple. The insects were confined for a period of from twenty-four hours to twenty days in a test-

tube with a little cotton-wool. The test-tube was kept in the laboratory incubator. The hungry insects were then placed in a large watch-glass with some cotton-wool and fixed by adhesive plaster and bandages to the selected site. In the case of flies and mosquitoes a light wire frame with netting was found preferable. An infiltrated area on the posterior surface of the forearm was found to be suitable and convenient. The following table summarizes the results of the examination of smears of insects so fed, made within half an hour of feeding:—

70 flies.—Enclosed over ulcerated leprotic surfaces. Two acid-fast bacilli found in stomach of one fly, and one in stomach of another.
80 mosquitoes.—One contained three acid-fast bacilli.
60 fleas.—Two contained acid-fast bacilli. Two bacilli in one flea, one in the other.
75 bugs.—Twenty contained acid-fast bacilli.

The bugs frequently contained acid-fast bacilli in the alimentary canal. The mosquitoes, fleas and flies very rarely contained bacilli, or they rapidly disappeared or were no longer recognizable; indeed, in the cases of the mosquitoes and fleas I hesitated some time in consideration of the isolated red rods as to whether they were actually bacilli or stained fragments of tissue; I therefore venture no further statements about them. After these preliminary experiments, attention was concentrated on bugs. Lepra bacilli are undoubtedly imbibed by the bug and are demonstrable without much difficulty in smears made from the *débris* of the intestinal canal. I say lepra bacilli advisedly; they retain their acid-fast staining and show the morphologic characteristics associated with this organism. No acid-fast bacilli were found in unfed bugs. They are usually isolated, but I have counted as many as twelve in one field. They do not readily disappear, but can be found up to sixteen days after the insects are fed. Acid-fast bacilli answering all characteristics of the lepra bacillus were also found in smears made from the tissue juices and circulating medium of bugs fed on lepers, in smears of the macerated head and of the proboscis (five days after feeding) and, finally, I found a bacillus once in the excreta deposited on the inner surface of the test-tube.

On May 2 last, some bugs were fed on a patient with well-marked tubercular leprosy who at the time showed a fresh crop of nodules, was feverish, and, in fine, exhibited all the signs of an acute exacerbation of the disease. When the insects had been affixed to the patient for eight hours they were removed and found distended with blood. Again, on the 15th day of the same month the same insects were re-applied to the same patient for a few hours. Next morning, the 16th, one insect was found dead. I made a smear of the stomach contents, and also of the body tissues well apart from the intestine. The former contained a few bacilli; in the latter, stained at the same time and by exactly the same method, field after field displayed squadrons and platoons of acid-fast bacilli. Their individual appearance differed considerably, however, from the classic lepra organism. They were shorter, some of them almost coccoid; they were more homogeneous in staining, displayed no granularity, had occasionally a median constriction, occasionally a terminal clubbing. The great majority were arranged in groups, the individuals of the groups showing a tendency to adhere in parallel formations, like the cohesion of floating logs. They appeared to me to be young lepra bacilli in full prolific activity—not having yet assumed the senile or degenerative forms usually observed in the impacted bacillary masses of human tissues.

Owing to the recent work of Drs. Clegg and Duval, who have shown that the presence of the amino-acids is essential for the artificial cultivation of the bacillus, I was able to compare these bacilli with others artificially cultivated. They were very similar. In some, though slight differences were recognizable, such differences were less than those observed in comparing different bacilli of the same slide. Careful comparison left little doubt in my mind that the organisms from the bug and those from the cultures were identical; it seems to me probable that the bug actually died of acute leprosy.

I have recently endeavoured to demonstrate the transmission of the bacillus by fed bugs to healthy tissues. Bacilliferous insects were applied to shaven areas on guinea-pigs, rabbits, and monkeys, and to the clean, unaffected arms of "arrested" maculo-anæsthetic lepers. Small portions of tissue surrounding the bite were excised immediately the insect left its mark and at varying times afterwards, and sections cut and stained. The results have, in the case of the lower animals, been uniformly negative. On one anæsthetic leper a small papule appeared at the site of the bite. This papule was excised but no bacilli were found in it; a definite bacillus was, however, found a considerable number of sections away from the edge of the papule, but whether it had been injected by the insect or had been deposited there previously or independently it was impossible to decide.

On consideration it will be apparent that it would be sanguine to expect any marked result from the application of these leper-fed bugs. Guinea-pigs and rabbits are uninoculable with leprosy, and leprosy bacilli, so far as my investigations have gone, rapidly disappear if injected into their tissues. As regards maculo-anæsthetic lepers, it seems to me that during most of the time they suffer from the disease they are partially immune and only their peripheral nervous system affords a suitable soil for the growth of the bacillus; if the disease be indeed "arrested" even this partial susceptibility disappears.

Reviewing the foregoing data, I venture to submit the following conclusions:—

(1) That considering the enormous numbers of lepra bacilli in the infiltrated or ulcerated skin and nasal mucosa of an active "tubercular" leper and the ingestion of bacilli by certain insects, direct contact and transmission by flies, fleas, mosquitoes,

or other insects are possible modes of spread of the disease; but such infection, if it ever does take place, is accidental and exceptional.

(2) That having found acid-fast bacilli answering as far as our imperfect tests permit to the characteristics of lepra bacilli in a considerable proportion (about 30 per cent. of specimens of *Acanthia lectularia* up to sixteen days after feeding on lepers) there is reason to believe that this species of insect constitutes a very important agent in the spreading of leprosy.

Unfortunately this view can be proven with finality only by the application of bugs previously fed on lepers to the persons of healthy individuals, with the resultant development of the disease, unless, indeed, it be found, as there is some reason to hope, that certain monkeys and anthropoid apes are susceptible of inoculation with leprosy.

In connection with the foregoing conclusions, I quote in brief a few details, obtained without leading question or suggestion, of the early history of a patient—a European of intelligence and with a clear memory of the onset of the disease. H. M., Number 1,039, aged at the time 11 years (whose father had been removed as a leper to this asylum some time previously and whom the son used frequently to visit), observed for the first time in the year 1901 a small red papule under his chin. It enlarged slowly, becoming in area, to use his own simile, about the size of a sixpenny-piece. It was indurated and resistant to treatment. It remained thus, slightly raised, hard, and of a reddish hue, for two complete years before any further symptoms appeared. In the year 1903 he noticed for the first time a bluish puffiness of his cheeks, later slight thickening of his eyebrows, and a diffuse but moderate swelling of the entire countenance. Towards the end of the year tubercles began to appear on his face. Thereafter tubercles continued to appear at irregular intervals on his face. The glands of his neck became involved. From this time onwards the tubercles and other typical signs were of universal distribution and showed a diffuse systematic infection.

The initial pimple, and later tubercle, on the chin would appear to have been the primary lesion, probably caused by the bite of a leprosy-infected bug.

In the communities where it is endemic leprosy is notoriously a disease of the dirtier classes. It is not, however, necessarily associated with poverty, except in so far as this is a concomitant of squalor. In South Africa, although leprosy is more prevalent among the lower strata of the population it is by no means confined to them. Of the cases in Europeans a considerable percentage is derived from families in which poverty and privation are unknown, but where the practice of the elements of domestic hygiene and cleanliness is in abeyance. Cases do occasionally occur in persons whose habits are, in general, cleanly, but on inquiry one sometimes finds that lapses from such habits have occurred, affording opportunity for the transmission of the infection by the means suggested. There is in this asylum, for example, a patient who once held a position of responsibility in a crack English regiment. He had always been of scrupulously clean habits when circumstances permitted. He states, however, that under the exigencies of campaigning in India and later in South Africa he frequently slept and retained for temporary use when no others were available blankets belonging to and previously used by natives.

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## INFANT FEEDING IN THE TROPICS.

By W. E. Deeks, M.A., M.D.
*Chief of Medical Clinic, Ancon Hospital.*

There are few problems more difficult for the practising physician to solve than the satisfactory artificial feeding of infants. Particularly is this true in the Tropics, where good cow's milk is not available. Unless the cattle are grain fed, the quality of the milk given is very inferior, and not suitable for infant feeding. Moreover, in warm climates bacterial growth is rapid, and before the milk can be properly taken care of it is so contaminated that its use for this purpose is a grave source of danger to the infant.

One has but to read of the difficulties encountered by the physicians in Africa, India and other tropical countries and the dreadful infant mortality, to appreciate the reasons why most white women prefer to go to a temperate climate to rear their children.

It is a well-known fact also that very few women in the Tropics are able to nurse their infants properly for any length of time, so that any method of artificial feeding which offers a satisfactory solution to this problem can be thoroughly appreciated.

In Panama these conditions had to be met, as many of the employees of the Canal Commission brought their families with them, and, moreover, very many child en were born here.

How this question has been solved, it will be my object now to show as evinced by the morbidity and mortality results of children admitted to Ancon Hospital between January 1, 1906, and March 1, 1911. Not all the children requiring medical attention in the Canal Zone are admitted to Ancon Hospital, but most of them who are seriously ill are sent here, as are also many from the city of Panama.

Racial habits differ materially, and no analysis would be fair if this fact was not considered. I have, therefore, for comparative purposes, grouped the cases into four classes: Americans, Panamanians, White Foreigners and Coloured. These have again been divided according to age into those under 2 years of age, and those over 2 but under 4. In all there were 370 admissions under 5 years of age, of whom 238 were under 2 years. The following table shows the number of cases in

the respective classes and ages above mentioned, specifying the chief affections which we are considering, viz., entero-colitis, and for comparative purposes, malaria. All affections except these are grouped under the head of "Other Diseases," brief reference being made below to the more important of them.

TABLE I.

| Nationality | Age | Malaria | | | | | No. of Deaths | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Æstivo autumnal | Tertiary | Clinical | Entero-colitis | Other diseases | Malaria | Entero-colitis | Other diseases |
| Americans ... | Under 2 yrs. | 1 | 1 | 10 | 51 | 45 | ... | ... | 3 |
| ,, .. | Over 2 but under 5 yrs. | 2 | ... | 13 | 9 | 28 | ... | ... | 1 |
| Panamanians ... | Under 2 yrs. | 3 | 2 | 5 | 20 | 17 | 1 | 1 | 7 |
| ,, | Over 2 but under 5 yrs. | 4 | ... | 2 | 2 | 5 | 1 | ... | 1 |
| White Foreigners | Under 2 yrs. | 3 | 3 | 9 | 9 | 10 | ... | ... | 2 |
| ,, | Over 2 but under 5 yrs. | 17 | 10 | 15 | 3 | 8 | 1 | 1 | ... |
| Coloured ... ... | Under 2 yrs. | 8 | 3 | 1 | 19 | 18 | 2 | 5 | 5 |
| ,, ... ... | Over 2 but under 5 yrs. | 4 | 1 | 1 | 2 | 3 | 3 | 1 | ... |

Five of the deaths from malaria were due to æstivo-autumnal infections. The ages and specific causes of death other than those due to malaria were as follows:—

*Americans.*—Meningitis, about 5 years; meningitis, 1 year; capillary bronchitis, 3 months; acute hydrocephalus, 7 months.

*Panamanians.*—Meningitis, 14 months; purpura hæmorrhagica, 3 months, 8 months, 22 months, and 7 months; syphilitic meningitis, 4 months; typhoid, 2 years; broncho-pneumonia, 1 month, and unspecified, 7 months.

*Spanish.*—Meningitis, 6 months; inanition, 9 days.

*Coloured.*—Tubercular meningitis, 5 months; sclerema and inanition, 4 months, and 1 day; disseminated tuberculosis, 4 months; infection undetermined, 1 year.

Among interesting cases which recovered were: Endocarditis, in an American under 2 years; one typhoid and one lobar pneumonia in coloured children under 2 years; two lobar pneumonias in American children between 2 and 5 years; and one lobar pneumonia in a Spanish child of the same age.

The total mortality from all causes was 35, or 9.3 per cent.; of these 13 occurred within twenty-four hours after admission and can scarcely be considered as treated cases. Eliminating these the mortality is 6.1 per cent. An analysis of those who died from malaria shows that four died within twenty-four hours after admission; three were complicated with capillary bronchitis, pneumonia, and nephritis respectively. One was admitted comatose, but lived for thirty-two hours.

Children admitted with constipation, colic and artificial feeding, are grouped with "Other Diseases." Of the cases grouped as "entero-colitis," they were diagnosed under the terms "entero-colitis," "ileo-colitis," "colitis," "dysentery," "diarrhœa," "marasmus," "malnutrition," and "bad feeding." They were all more or less grave digestive disturbances due to improper feeding. Of these 115 cases 99 were under 2 years of age. Two of these were admitted moribund and died within twenty-four hours after admission. Eliminating these, we had 113 admissions, with six deaths, a mortality of 5.3 per cent. Of these six, one lived for two days, and one for four days after admission. Little can be done for infants when they are in such grave condition when admitted. Excluding these, the mortality is 3.6 per cent.

That these results are due to proper feeding and not to climatic conditions, we have abundant evidence to show. Panama city affords us evidence on this point. I am indebted to Dr. J. C. Perry, Health Officer, of the City of Panama, for a list of the deaths among infants under 1 year and children from 1 to 4 years, inclusive, since the American Government was in charge of sanitation.

TABLE II.

| Month | 1906 | | 1907 | | 1908 | | 1909 | | 1910 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Under 1 yr. | 1 to 4 yr. | Under 1 yr. | 1 to 4 yr. | Under 1 yr. | 1 to 4 yr. | Under 1 yr. | 1 to 4 yr. | Under 1 yr | 1 to 4 yr. |
| January ... | 28 | 1 | 22 | 3 | 27 | 7 | 28 | 8 | 25 | 7 |
| February ... | 10 | 3 | 15 | 1 | 14 | 4 | 24 | 7 | 24 | 5 |
| March ... ... | 13 | 1 | 13 | 1 | 21 | 4 | 21 | 7 | 26 | 5 |
| April ... .. | 19 | 1 | 17 | 3 | 23 | 1 | 23 | 1 | 57 | 6 |
| May ... ... | 35 | 11 | 21 | 4 | 26 | 3 | 23 | 1 | 35 | 12 |
| June ... ... | 16 | 7 | 35 | 4 | 43 | 7 | 34 | 3 | 45 | 9 |
| July ... ... | 26 | 10 | 45 | 10 | 41 | 7 | 29 | 9 | 29 | 7 |
| August ... .. | 18 | 5 | 20 | 5 | 28 | 9 | 21 | 10 | 24 | 11 |
| September .. | 22 | 2 | 29 | 2 | 25 | 5 | 28 | 1 | 34 | 11 |
| October... ... | 15 | 2 | 25 | 2 | 31 | 6 | 27 | 7 | 46 | 12 |
| November ... | 22 | 2 | 34 | 10 | 37 | 7 | 29 | 6 | 52 | 15 |
| December ... | 23 | 5 | 40 | 7 | 32 | 4 | 25 | 4 | 57 | 24 |
| Totals ... | 247 | 50 | 316 | 52 | 348 | 64 | 312 | 64 | 454 | 124 |

The total population for these years is estimated as follows:—1906, 25,000; 1907, 33,000; 1908, 37,000; 1909, 43,000; 1910, 45,000.

There are no reliable statistics of the birth-rate in Panama, so that it is impossible to compare it with the death-rate of children under 1 year of age.

If we take, however, the statistical report of the City of Providence, R.I., as compiled by Dr. Charles V. Chapin, we find that the population of 1909 was estimated at 217,000, or about five times that of the estimated population of Panama. The number of births in that year were 5,607, or one to 38.7 *per capita* of population. The death-rate from diseases of all causes under 1 year of age was 756,

or 13.4 per cent. of the birth-rate, and from diarrhœal diseases alone 165, or a little less than 3 per cent.

For the same year in Panama with one-fifth the population, the deaths under 1 year from all causes numbered 312, most of which were due to diarrhœal affections, as there was at that time no measles, scarlet fever, or diphtheria as contributary causes. Had the birth-rate in Panama been the same as in Providence, there would have been about 1,100 births, of whom 312 died before they reached 1 year of age, or 28 per cent.

The birth-rate, though, was probably higher, and it is a safe estimate that 20 per cent. of the babies born in Panama died before they reached the age of 1 year, and the greater number of these from preventable causes.

The great increase in population has been through new arrivals, chiefly coloured, and the deaths have been confined largely to the children of these, and of the Panamanians of the poorer class. They never use anything but the sweet condensed milks and paps made from all sorts of starchy foods when they are unable to nurse their babies. The result is entero-colitis, marasmus, inanition and death.

That these deaths are due to entero-colitis consequent on bad feeding, and not to malaria or any epidemic disease, is proven by the fact that there is no exacerbation in the curve of morbidity or mortality throughout any part of the year. It is more or less the same irrespective of season which influences other diseases.

It must be admitted that our mortality rate was extremely low, and particularly so in those cases due to entero-colitis and allied conditions. This being the case, it will now be my object to show the method of feeding which will give these results.

Although good cow's milk is available in the hospital from a herd under the direct supervision of the Hospital Superintendent, it is seldom used for infant feeding as it is not accessible for the use of children outside the hospital. Other means had, therefore, to be adopted which were of universal application, and the results have proven these to be perfectly satisfactory.

Dr. A. B. Herrick, of this hospital, initiated the method in 1906, and it has been modified as experience has taught us since, so that now we have a perfectly satisfactory and cheap method of infant feeding.

From a series of analyses that were made in the laboratory under Dr. S. T. Darling's supervision, by Mr. J. E. Jacobs, the following results on human milk were obtained:—

From a general survey of the above table it can be seen that the average milk of the colored women is richer than that of the American women, and that the tendency of the milk of the American women is to deteriorate in quality as the infant's age increases. Moreover, it must be observed how extremely variable the quality of milk is in different mothers, and how important it is to have an analysis of the milk made if the child is not improving satisfactorily. Artificial feeding, therefore, in part or in whole, becomes a necessity, and this had to be met with where fresh cow's or goat's milk was not available. Our object has been to approximate as nearly as possible the composition of human milk.

TABLE III.

| | Nationality | Age of infant | Total solids | Fats | Lactose | Proteid | Ash | |
|---|---|---|---|---|---|---|---|---|
| | American ... | ? | 12·15 | 2·20 | 7·09 | 2·68 | ·18 | White |
| | ,, ... | ? | 11·56 | 2·40 | 6·80 | 2·14 | ·22 | |
| | ,, ... | ? | 10·69 | 1·37 | 7·24 | 1·88 | ·20 | |
| | ,, ... | 3 days | 11·51 | 2·40 | 5·60 | 3·23 | ·28 | |
| | ,, ... | 12 days | 12·20 | 3·20 | 6·20 | 2·71 | ·13 | |
| | ,, .. | 9 days | 11·10 | 3·00 | 5·20 | 2·76 | ·14 | |
| | ,, ... | 9 days | 11·80 | 3·15 | 5·60 | 2·90 | ·15 | |
| | ,, ... | 10 days | 11·39 | 2·40 | 6 02 | 2·83 | ·14 | |
| | ,, ... | 4 months | 12·14 | 1·20 | 6·00 | 4·84 | ·10 | |
| | ,, ... | 6 months | 10·91 | 3·20 | 6·30 | 1·34 | ·07 | |
| | ,, ... | 11 months | 11·96 | 3 00 | 6·20 | 2·62 | ·14 | |
| | ,, ... | 11 months | 8·25 | 1·00 | 6·00 | 4·84 | ·10 | |
| | General average | | 11·22 | 2 33 | 6·25 | 2·48 | ·16 | |
| | Panamanian | 3 days | 11·51 | 2·40 | 5·60 | 3·23 | ·28 | Coloured |
| | ,, | 8 days | 13·28 | 4·50 | 5·80 | 3·28 | ·20 | |
| | ,, | 9 days | 11·80 | 3·15 | 5·60 | 2·90 | ·15 | |
| | Grenadian .. | 9 days | 11·30 | 3·40 | 5·30 | 2·36 | ·24 | |
| | Jamaican ... | 8 days | 14·98 | 6·20 | 5·00 | 3·78 | ·18 | |
| | ,, ... | 8 days | 14·38 | 4·40 | 5·80 | 3 97 | ·21 | |
| | ,, ... | 9 days | 14·30 | 5·52 | 6·48 | 1·93 | ·37 | |
| | Barbadian ... | 8 days | 12·03 | 3·00 | 5·50 | 3·53 | ·28 | |
| | ,, ... | 8 days | 13·61 | 4·38 | 6·38 | 2·67 | ·18 | |
| | ,, ... | ? | 11·98 | 3·20 | 7·00 | 1·58 | ·20 | |
| | ? | ? | 13·18 | 4·00 | 5·20 | 3·81 | ·17 | |
| | General average | | 12·94 | 4·01 | 5·78 | 3·00 | ·21 | |
| | General average among American women within ten days of parturition | | 11·60 | 2·83 | 6·52 | 2·88 | | |

Because of the large carbohydrate content (66 to 89 per cent.) in all prepared infant foods, and the practical impossibility of diluting them to approach the contents of mother's milk, we have excluded them from our diet list. We have found that if an infant can assimilate them, it became fat and inactive, with slow and difficult dentition, and suffered from constipation or occasional attacks of diarrhœa. In warm climates this generalization can be made: That the whole group of malted milk and prepared infant foods with a high carbohydrate content is to be avoided in infant feeding.

We therefore have left to consider the condensed milks, sweetened and unsweetened. A series of brands purchased here in the open market were analysed by Mr. J. E. Jacobs, with the following results:—

Of 700 analyses the following average composition of cow's milk is given by Konig.—Casein, 2.88 per cent.; lactalbumin, 51 per cent.; fat, 3.68 per cent.; and sugar, 4.90 per cent. Considering the first two together as proteid, we have: Fat, 3.68

TABLE IV.—ANALYSES OF EIGHT SAMPLES OF CONDENSED MILK.

| | No. 1 | No. 2 | No. 3 | No. 4 | No. 5 | No. 6 | No. 7 | No. 8 |
|---|---|---|---|---|---|---|---|---|
| | Per cent. | Per cent. | Per cent. | Per cent. | Per cent. | Per cent. | Per cent. | Per cent. |
| Total solids | 74·99 | 77·50 | 75·42 | 72·31 | 31·55 | 25·93 | 27·08 | 23·77 |
| Fat | 10·75 | 9·56 | 10·04 | ·39 | 9·60 | 8·40 | 8·40 | 7·20 |
| Lactose | 12·50 | 13·73 | 10·23 | 14·94 | 11·78 | 10·10 | 10·19 | 9·35 |
| Proteids | 7·66 | 11·71 | 9·63 | 8·97 | 8·25 | 5·94 | 7·01 | 6·25 |
| Saccharose | 42·50 | 40·80 | 43·63 | 46·00 | 0 | 0 | 0 | 0 |
| Ash | 1·58 | 1·70 | 1·89 | 2·01 | 1·92 | 1·49 | 1·43 | ·07 |

No. 1.—Nestlé's condensed Swiss milk, prepared by Henri Nestlé, Vevey, Switzerland.
No. 2.—Nestlé's condensed milk, prepared in England, Henri Nestlé.
No. 3.—Condensed milk, Milkmaid brand, prepared in England, Anglo-Swiss Condensed Milk Company, Switzerland and London.
No. 4.—Condensed milk, prepared in Lombardy.
No. 5.—Nestlé's unsweetened milk, condensed.
No. 6.—St. Charles' unsweetened evaporated milk, St. Charles' Condensing Company, St. Charles, Illinois.
No. 7.—Libby's unsweetened sterilized evaporated milk, Libby, McNeil and Libby, Chicago, Illinois.
No. 8.—Borden's Condensed Milk Company, New York, U.S.A.

per cent.; sugar, 4.90 per cent.; and proteid, 3.39 per cent.

Cow's milk, like human milk, varies extremely. The race, food, period of lactation, hygienic surroundings and individual idiosyncrasies are all modifying factors. From the above analyses it can be seen that the sweet condensed milks are cow's milk reduced to from 35 to 40 per cent. of their volumes, and from 40 to 44 per cent. of cane sugar added thereto.

The condensed milk made in Lombardy is evidently prepared from skimmed milk; as it is practically free from fats it should not be used for infant feeding. The unsweetened condensed, or concentrated milks are made from cow's milks reduced to about 40 per cent. of their volumes. If we average the composition of the three first sweetened milks, we have: Fats, 10.11 per cent.; lactose, 12.08 per cent.; proteid, 9.67 per cent.; and saccharose, 42.31 per cent. This will be the standard for our formulæ. The average composition of the unsweetened, concentrated, or evaporated milk is: Fat, 8.40 per cent.; lactose, 10.35 per cent.; and proteid, 6.86 per cent. Using these analyses as our basis, the milk is modified according to age as follows, with the composition set after each formula:—

TABLE V.

| Sweetened condensed | Unsweetened condensed | Water | Fats | Condensed sugar | Proteid |
|---|---|---|---|---|---|
| 1 | 3 | 60 | ·55 | 1·33 | ·47 |
| 1 | 3 | 50 | ·65 | 1·58 | ·56 |
| 1 | 3 | 40 | ·80 | 1·93 | ·68 |
| 1 | 3 | 30 | 1·03 | 2·51 | ·85 |
| 1 | 3 | 24 | 1·26 | 3·05 | 1·08 |
| 1 | 3 | 20 | 1·43 | 3·55 | 1·26 |
| 1 | 3 | 16 | 1·76 | 4·26 | 1·51 |
| 1 | 3 | 12 | 2·20 | 5·33 | 1·88 |
| 1 | 3 | 10 | 2·52 | 6·09 | 2·16 |
| 0 | 3 | 6 | 2·80 | 3·45 | 2·29 |

Human milk does not become richer as the infant grows older, but generally decreases in food value. The increasing demands of the infant are met by increased quantity, and not quality. It has been our experience here that the formulæ—1, 2, 3, according to the above table, gives as nearly a perfect result as possible after the first month. As cane sugar is much sweeter than milk sugar, there should be a lower percentage of it than of milk sugar.

It must not be overlooked that the unsweetened milks must be kept in a cool place after the can is opened, and carefully corked with sterile cotton. It is better, also, to purchase small cans, opening a fresh one every morning. As some of the cans are not properly sealed, always observe the milk closely on opening, for contamination or sourness.

The sweet condensed milks keep much better, but must not be exposed where flies, ants, &c., have access to it.

To each bottle add one to two teaspoonfuls of lime water, or, if constipation is present, one teaspoonful of milk of magnesia. In preparing a bottle always add some boiling water to the measured quantity of sweet condensed milk; dissolve thoroughly; then stir in the unsweetened milk; then add sufficient boiling water to make the desired quantity; then the lime water, and a few grains of table-salt and allow to cool until the proper temperature is reached. One needs but a graduate of 8 oz. or a bottle graduated to one-quarter drams, and the process is simple.

It is always wise for the mother or the nurse to taste the milk before adjusting the nipple to the bottle in order to see that the preparation is not soured.

After six months barley water in whole or in part can be used as a diluent, and after nine months it or oatmeal jelly. They are made in this hospital by Miss Barr, in charge of the diet kitchen, as follows:—

Barley water: One tablespoonful of pearl barley after being washed is added to one pint of cold water and soaked for ten or twelve hours, and then strained. One quart of cold water is then added and boiled slowly for two hours. Water is added

TABLE VI.—TABLE FOR INFANT FEEDING.

| Age of infant | Formula | Amount of each feeding | Interval of feeding | Number of feedings daily | Diluent |
|---|---|---|---|---|---|
| 1 day | Plain boiled water two or three times | | | | |
| | *x* *y* *z* | | | | |
| 2 days | 1 3 60 | ½ to 1 oz. | 2 hours | 6 to 8 | Boiling water |
| 3 days | 1 3 50 | ½ to 1 oz. | 2 ,, | 8 | ,, |
| 4 days | 1 3 40 | 1 oz. | 2 ,, | 10 | ,, |
| 5 days | 1 3 30 | 1 oz. | 2 ,, | 10 | ,, |
| 6 days | 1 3 24 | 1½ oz. | 2 ,, | 8 to 10 | ,, |
| 7 days | 1 3 20 | 1½ oz. | 2 ,, | 8 to 10 | ,, |
| 1 to 4 weeks | 1 3 16 | 2 oz. | 2 ,, | 8 | ,, |
| 4 weeks to 3 months | 1 3 12 | 3 to 4 oz. | 2½ ,, | 7 to 8 | ,, |
| 3 months to 6 months | 1 3 12 | 5 to 7 oz. | 3 ,, | 7 | ,, |
| 6 months to 9 months | 1 3 12 | 7 to 9 oz. | 3½ ,, | 6 | Barley water |
| 9 months to 12 months | 1 3 12 | 8 to 10 oz. | 4 ,, | 5 | ,, |

*x* = Sweet condensed milk. *y* = Unsweetened condensed milk. *z* = Boiling water, or after six months of age, barley water.

from time to time so that the end product consists of one pint. It is then seasoned with half a teaspoonful of salt, and strained through muslin or a fine sieve.

If Robinson's Patent Barley is used, Koplik recommends the following method of preparation: A heaped teaspoonful is suspended in a pint of cold water until the lumps have disappeared. The mixture is then placed in a small saucepan over a fire and stirred constantly for fifteen or twenty minutes after it begins to boil. Water is then added to make the mixture up to one pint.

Oatmeal Jelly: This is made as follows: One cup of rolled oats is soaked in two cups of cold water for ten or twelve hours, then strained through a fine sieve or muslin. One cup of cold water is now added, and the mixture is gently boiled for two hours, stirring frequently. One half teaspoonful of salt is now added, and when allowed to cool, the product jellies. Two to four teaspoonfuls of this jelly can be added to each bottle after the infant is nine months old. It is particularly valuable if there is a tendency to constipation.

After the infant is one year old the formula, 1, 3, 10, can occasionally be utilized. From one year on also, an egg can be given daily, either in the milk, placed in boiling water for eight or ten minutes, when it jellies; or it can be lightly boiled and a plain cracker, rusk, or well-toasted stale bread with butter, can be given with it. Not more than five feedings should be given daily. After fifteen months, two eggs may be given daily, one in the morning and one in the afternoon, and the number of feedings reduced to four. After eighteen months a light general diet can be initiated with four feedings daily, the last one of which should be plain milk, or a cereal with milk, without sugar. After eighteen months no sweet condensed milk is used, but one of the unsweetened condensed milks diluted with twice as much water. This makes a wholesome, nutritious milk food. After two years of age the child should be fed but three times daily, and absolutely nothing but water be given between meals.

Fruit juices fresh and unsweetened, preferably orange, should be administered every morning from the third month on directly after waking. At first ten or fifteen drops increasing gradually, so that at twelve months the child can be allowed the juice of one or two oranges. Green vegetables should be given after the eighteenth month.

### CONDITIONS ONE MEETS WITH THAT CONCERN THE MOTHER.

*Teething.*—In well-nourished children there are four periods when the teeth erupt, and give rise to more or less general disturbances during the first two years. They are about the sixth, eighth, twelfth, and eighteenth months. The time is uncertain, and may vary one or two months from the periods named. The disturbances may take the nature of constipation, vomiting, diarrhœa, convulsions, vicarious rashes, restlessness, fever, and irritability, particularly at night. The better nourished the child is the less likely are any of them to occur.

*Vomiting.*—This is a common symptom. If artificially fed by the above described method, and no other cause can be attributed, use a weaker formula for a few days. Vomiting and absolute anorexia with high fever and sometimes diarrhœa, is a symptom of milk poisoning. It shows that either the milk was bad when the can was opened, or had not been carefully cared for after being opened.

Food with too much sugar and other carbohydrates in a child is directly responsible for fever, entero-colitis, eczema, enuresis, rheumatism, recurring bronchitis, pustular dermatitis, stomatitis, and dry, lustreless hair. The so-called curds in the stool are common in artificially-fed children. They are of little significance and are generally not curds, but fatty-acid soaps.

When a child is not thriving, never forget the possibility of constitutional lues. Mercury promptly gives relief.

The onset of the acute infectious diseases must always be considered, and in the Tropics malaria particularly.

In this paper I have endeavoured to show that tropical infant feeding is not a serious problem, and has given us here as nearly perfect results as can be obtained by any other method. The same measures can be applied in warm climates the world over. The feed is low in fat contents, but this is not as necessary a constituent of the food in warm weather as in cold. This method of feeding gives

a sterile, wholesome food, which rarely ever disagrees and the large number of fine, healthy babies on the Isthmus bear eloquent testimony to its value.

Its cheapness should appeal to the poorest class of people. Even when purchased at retail prices in Panama (30) thirty cents worth of milk will make 160 oz. of food after the formula 1..3..12. This is at the rate of 3/16 cents an oz., or 1-1/2 cents for a feeding of 8 oz.

In this method of infant feeding we have a sterile, cheap, perfectly satisfactory food, worthy of more extended use. That its use here has given us brilliant results has been fully demonstrated.

## LONDON SCHOOL OF TROPICAL MEDICINE.

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F. Grone, M.B.Lond., D.P.H.
E. C. Braithwaite, M.B., B.S. (Colonial Service).
L. W. Davies, M.D.Edin. (Colonial Service).
J. T. Wigham, M.D., D.P.H.Dub.
R. E. Drake-Brockman, M.R.C.S., L.R.C.P. (Colonial Service).
Major A. Moorhead, I.M.S., M.B., C.M.Edin.
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W. H. Bomford, L.R.C.P. and S.I. (Colonial Service).
J. Bruce Bays, M.D., M.B., M.R.C.S.

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D. E. Anderson, M.D.Paris, M.B.Lond.
Captain F. V. O. Beit, I.M.S., M.B.Lond.
F. Grone, M.B.Lond., D.P.H.
Captain J. H. Murray, I.M.S., M.B.Lond., M.R.C.S., L.R.C.P.
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AUGUST 1, 1911.

## BRITISH MEDICAL ASSOCIATION.

### TROPICAL MEDICINE.

THE attendance at the Section of Tropical Medicine was, as usual at these meetings, excellent, an average of seventy being present on the three days on which the Section met. The line of the discussion reached the high level we are accustomed to associate with gatherings of medical men practising in the Tropics, where everyone is an expert and an enthusiastic observer.

Sir Francis Laking, the President, in his opening remarks, expressed the feeling of the meeting in regard to the great loss tropical medicine had sustained by the death of Sir Rubert Boyce, and a formal resolution embodying this feeling was passed by the members present. Sir Francis also offered his congratulations to Sir Ronald Ross on his recently acquired title; this was cordially endorsed by everyone.

The discussion on July 26 was opened by Dr. C. J. Martin, F.R.S., the subject chosen being "Plague in its Endemiological and Epidemiological Aspects." Dr. Martin gave a precise and categorical account of recent investigation in plague; the part played by the rat flea in the transmission of the disease still holds the important position assigned to it some years ago, although infection by way of the alimentary canal cannot be neglected. Direct trans-

mission by sputum infection in pneumonic plague also brings another medium of transmission into the category. That a variety of methods of transmission is probable would seem theoretically to be well-nigh incontestable, for the ravages of plague are altogether inexplicable on the assumption that the rat flea is the only channel. The marmot in Mongolia and the ground squirrel in Western America are the animals next the rat most affected by plague, and it may be that the marmot is the rodent in which plague persists endemically to a greater extent than in any other. The rat is known to be subject to the epidemic form of plague, but that it is an endemic form of the disease has not yet been proved. The recurrences of plague were referred to by several of those who took part in the discussion, but no satisfactory explanation was given why plague appears year after year at the same periods almost to a day. It is a summer ailment in one place and a winter ailment in another, although these places are in latitudes which proclaim well-nigh identical climates.

Yellow fever was the discussion apportioned to the second day of the discussion. This was ably opened by Dr. J. W. W. Stephens, of the Liverpool School of Tropical Medicine. The number of those present who had acquaintance with this disease was surprising, and these experiences were most valuable. The whole question is one of diagnosis, and until this is established, by some means yet to be discovered, the relationship of bilious remittent fever to yellow fever cannot be ascertained. The fact that in yellow fever no parasite has been found accounts for the discrepancy in records. The method of research necessary, assuming that a further search for the yellow fever parasite is futile, would seem to be the elucidation of bilious remittent fever. Is this disease of malarial origin or not? It would seem that this point admits of ready solution; but, bearing in mind the fact that even blackwater fever is not grouped with any scientific precision with malaria, the inquiry concerning the bilious remittent is not so simple as it would appear. The experimental method should afford us a fruitful channel of inquiry. We know that yellow fever is transmitted at a particular time by a particular mosquito; is bilious remittent similarly transmitted? If it is, the identity of the two ailments is advanced a step; if not, then there is some evidence that we are dealing with different diseases. Has mosquito experimental work been carried out in the case of bilious remittent fever? We are not aware that it has, and until that is done we must be content to remain in ignorance, unless some other means of differential diagnosis crops up to help us. That yellow fever exists on the West Coast of Africa all seem agreed upon; that it is endemic there is probable, and that the explanation of outbreaks in epidemic form being so rare amongst adults is that the children are rendered immune by attacks during childhood.

Professor W. J. R. Simpson, C.M.G., on Friday, July 28, introduced the subject of sanitation of villages and small towns in the Tropics, with special reference to efficacy and cheapness. All attention in every country is paid to the sanitation of towns and cities, and the villages and rural dwellings are for the most part left to the discretion and intelligence of the residents, which, as a rule, in matters sanitary is not high. Seeing, however, that the water supply of towns is derived from these neglected regions, and that the milk, vegetables, and fruit are also sent into town from thence, the importance from every point of view, local and general, of these rural districts is of primary importance, and requires to be dealt with scientifically. The difficulty is, however, men and money, and until a sufficient number of trained Public Health Officers are provided with money at their disposal to carry out necessary remedies the present unsatisfactory system must go on. There is no doubt that amongst Europeans in India, at any rate, the bungalow system of building dwelling-houses is the cause of much illness, traceable directly to insanitation. A bungalow was evidently intended for a temporary dwelling, and many are built immediately upon the ground, no air space intervening. By and by the wood undergoes "dry rot," the soil beneath gets fouled, and an unhygienic dwelling is the result, with its usual accompaniments. Of these the most serious is the danger to women after child-birth. For two or three weeks after the birth of a child the woman is exposed night and day to whatever emanations there may be from a bungalow of some thirty or forty years old, and septic poisoning is not an uncommon result.

Many interesting papers were read before the Section, an account of which will be given in the next number.

## Abstracts.

### FINAL REPORT OF THE DEPARTMENTAL COMMITTEE ON HUMIDITY AND VENTILATION IN COTTON-WEAVING SHEDS: EFFECTS OF ATMOSPHERIC HEAT AND HUMIDITY ON THE TEMPERATURE OF THE BODY.

By Matthew D. O'Connell.

THE perusal of this Report will interest students of Tropical Medicine, as it is the first time that the effect of a hot, damp atmosphere, pure and simple, has upon the temperature of the body has been studied on a large scale.

The operatives in the cotton-weaving sheds of Lancashire having complained that they suffered from bodily discomfort, lassitude, want of energy, enervation, and injury to health from the hot, moist atmosphere in which they carry on their work, H.M's. Secretary of State for the Home Department appointed a Committee in 1907 to enquire and report on the subject.

Amongst other questions which the Secretary of State asked the Committee to answer is the following:—

(2) At what degrees of heat and humidity combined, definite bodily discomfort arises, and what, if any, danger to health is involved by continuous work at those degrees?

In January, 1909, the Committee issued its first Report, from which it was clear that the hot, moist atmosphere in the sheds in which the weavers work causes bodily discomfort during the hot summer months. That it caused injury to health was not, however, proved, although, as the Committee said, inferences might be drawn from the evidence. The Committee promised a further Report.

The evidence to which the Committee refer is apparently that of distinguished physiologists, who were unanimous in recommending that when the wet bulb temperature of the air within the sheds reaches 75·0° F., all artificial humidification of the air should cease, for an increase of wet bulb temperature above this point would cause an increase of body temperature.

The final Report (Wyman and Sons, Fetter Lane, E.C., price 3s. 3d.) has now been issued, and it contains definite proof that exposure to a wet bulb temperature, even as low as 65° F., within the cotton sheds raises body temperature, and accelerates pulse and respiration.

Appendix II., Table I., contains the results of 237 observations on the body temperature of weavers at their ordinary work within the humid cotton sheds. Of these, the mouth temperature of 61·7 per cent. was found to be increased, of 29·1 decreased, and of 9·2 unchanged.

Appendix II., Table V., contains details of the mouth temperatures, pulse-rate, and respiration-rate, and the atmospheric conditions within the sheds. Of these I give below a small number, to give all would take up too much space. The few given, however, cover a range of wet bulb temperature of the air within the sheds from 80° F. to as low as 65° F.

| Atmospheric temperature in sheds, Fahrenheit. | | Body Temperature F. in Mouth | Pulse | Respiration |
|---|---|---|---|---|
| Dry | Wet | | | |
| Degrees. | Degrees. | Degrees. | | |
| 88·0 | 80·0 | 100·0 | 108 | 16 |
| 87·0 | 79·0 | 100·4 | 108 | 24 |
| 85·5 | 78·0 | 99·6 | 96 | 28 |
| 85·0 | 77·0 | 100·4 | 126 | 24 |
| 84·5 | 77·5 | 100·3 | 130 | 22 |
| 84·0 | 77·0 | 100·3 | 84 | 25 |
| 83·0 | 75·0 | 99·3 | 92 | 16 |
| 82·0 | 76·0 | 99·2 | 88 | 14 |
| 81·0 | 75·0 | 100·0 | 92 | 22 |
| 80·0 | 75·0 | 99·2 | 92 | 28 |
| 79·0 | 73·5 | 100·2 | 110 | 24 |
| 78·0 | 73·5 | 100·0 | 100 | 30 |
| 77·0 | 73·0 | 100·1 | 100 | 18 |
| 76·0 | 72·0 | 99·4 | 88 | 20 |
| 75·0 | 69·5 | 100·2 | 110 | 18 |
| 74·0 | 70·0 | 100·0 | 98 | 22 |
| 73·0 | 67·0 | 99·0 | 80 | 16 |
| 72·0 | 67·0 | 99·6 | 93 | —* |
| 69·0 | 65·0 | 100·0 | 100 | 26 |

* Taken from Appendix III, Table II, to complete series as far as possible.

These are only a few of the observations made by medical men, which show that the hot, moist atmosphere of the cotton sheds raises the body temperature of 61·7 per cent. of those working therein during the hot days of the summer months.

As regards the injury to health caused thereby, Professor Haldane, in his evidence before the Committee, said; "I am not aware of any serious injury to health from working in warm or moist air, provided that any considerable rise of body temperature is avoided."

Dr. Leonard Hill in his evidence said: "I cannot conceive that their (the operatives) body temperature should be often raised, almost daily, without in the end their becoming more or less injured in health."

Dr. Pembrey in his evidence said: "The prolonged exposure to the hot, moist atmosphere would appear to be more injurious than exposure to even higher temperature (wet bulb) for a shorter time."

From the second Report, then, it appears that the hot, moist atmosphere in which the weavers carry on their work on certain days, when the dry and wet bulb temperatures of the air within the sheds are as given above, not only causes bodily discomfort but also produces an increase of body temperature.

The Committee make a number of practical recommendations which should have the effect of mitigating the evil, but the greater hope for entirely ending it is contained in their statement that experiments are being made with a new appliance for local humidification of the warp, which will obviate the need for general humidification of the whole breathing area within the sheds in which the weavers carry on their work. These experiments, if successful, should completely solve the difficulty as regards the weavers in the cotton sheds.

Interest in these reports, however, will not be confined within the limits of the Cotton Weaving Industry of Lancashire. For if certain definite degrees of atmospheric heat and moisture within the humid cotton sheds increase body temperature, will not similar degrees of heat and moisture elsewhere produce the same effect.

The degrees of heat and moisture of the atmosphere which prevail *throughout the night* for several months of every year, in the unhealthy or "fever" season, following the rains, in warm and hot climates, very closely resemble those given above which raised the body temperature of the weavers in the cotton sheds. Has such environment no effect in causing the pyrexias of short duration which then become so prevalent?

It is unreasonable to assume that it has not. Indeed it is more likely to raise the body temperature of those exposed to it, than the atmosphere of the humid cotton sheds for the following reasons.

The weavers are exposed to the environment which raises their body temperature for only four or five hours at a stretch at most. For they leave the sheds for an hour twice daily for food, and for shorter periods for other purposes.

On the other hand during the fever season of the year in warm and hot climates the inhabitants pass the whole night from 6 p.m. to 6 a.m., twelve hours, in an atmosphere similar to that which raises the body temperature of the weavers. There is no escape from it until sunrise when the atmosphere

becomes gradually very much hotter and drier, thus permitting free evaporation of water from the skin and lungs.

It may be said that if the hot, damp, stagnant night atmosphere of the unhealthy season in warm and hot climates has any etiological connection with the pyrexias which then prevail, such pyrexias should be far more prevalent even than they are.

But it is seen in the reports under consideration that the hot damp atmosphere in the humid cotton sheds only raised the body temperature of 61·7 per cent. of those exposed to it. And when it is considered how such an atmosphere raises body temperature the reason why 38·3 per cent. did not show any increase may become apparent.

In the first place such an atmosphere impedes heat loss from the body. It would seem also that it must increase heat production in the body in the following way. Excretion of water through the kidneys depends, amongst other things, on the atmospheric temperature. As the atmospheric temperature rises the amount of water excreted through the kidneys decreases. As atmospheric temperature falls the amount of water excreted through the kidneys increases.

Evaporation of water from the skin and lungs depends not on the temperature but on the drying power or dampness of the air. As the drying power of the air increases the amount of water vapour given off from skin and lungs increases and *vice versa*.

Now in a hot damp atmosphere the excretion of water through the kidneys is impeded by the high temperature of the air and evaporation of water from skin and lungs is impeded by the dampness. As the excretion of water from the body is thus impeded it would seem that water must be retained in the blood. But an increase of water in the blood increases metabolism or heat production in the body. The experimental injection of pure distilled water into the blood causes a temporary rise of body temperature. I think then that exposure to a hot moist atmosphere raises body temperature not only by impeding heat loss from the body, but also by causing an accumulation or increase of water in the blood and thereby increasing metabolism or heat production in the body.

If this be true it seems to me that the personal element which keeps the body temperature of 38·3 per cent. from rising when exposed to such environment, in other words, which confers *immunity*, whether in the humid cotton sheds or in the hot, damp, stagnant night atmosphere of the fever season in warm and hot climates, is the condition of the individual's blood before exposure as regards the amount of water in it. Some have normally more water in their blood, some have less. If body temperature is raised in the way above described by exposure to a hot damp atmosphere the former would be more liable to such increase than the latter. The body temperature of the former would respond more quickly and to a higher degree. The body temperature of the latter would respond more slowly, if at all. The body temperature of the former would rise from short exposure. The body temperature of the latter would only rise after long exposure, if at all.

But however this may be the student of tropical medicine will find much to interest, if not indeed to enlighten him regarding the effect of a hot damp atmosphere on body temperature in the Reports of the Committee on Humidity and Ventilation in Cotton Sheds.

## Annotations.

*Salvarsan.*—There always appear to be two sides to every question, and the tide of opinion which up to the present has run more or less strongly in favour of the treatment of syphilis by salvarsan is now becoming a little slacker and is even beginning to ebb. Marshall criticizes the salvarsan treatment of syphilis in the *New York Medical Journal* for July 15, 1911, and without identifying oneself in any way with his conclusions, it is nevertheless right that both sides of the question should be put before the readers of the JOURNAL OF TROPICAL MEDICINE, and we therefore give his views *in extenso*. He states that a considerable number of deaths have been recorded after treatment by salvarsan, and that it is also well known that other deaths have occurred which have not been recorded. Some of these deaths, he says, have occurred in cases which were hopeless, others have been excused on account of faulty technique (such as intravenous injection of insoluble preparations). With regard to the question of optic atrophy which led to the abandonment of atoxyl and arsacetin, it does not appear quite clear whether this has yet resulted from salvarsan. A case, he says, has been reported, but as the patient had been previously treated with atoxyl, arsacetin, and enesol, it cannot be held to be conclusive. Nevertheless, he states that Isaac mentions two cases in which "blindness" resulted, and Starr mentions the case of a tabetic patient who became almost totally blind six weeks after an injection of salvarsan. Ocular paralysis and labyrinthine disturbance have been reported by Stern, Finger, and others, and Finger goes so far as to say that this neurotropic action of salvarsan contraindicates its use in the ordinary treatment of syphilis. Next Marshall quotes Buschke as pointing out that deposits of salvarsan in the tissues are known to produce necrosis, as shown by the numerous cases of necrosis of the gluteal muscles which have occurred after intramuscular injection. Buschke thinks it possible even that microscopic foci of necrosis may be produced in the internal organs after injection of the drug, and that these may predispose to further manifestations of visceral syphilis. Symptoms of pulmonary embolism have occurred after intravenous injection of salvarsan, and Mackintosh mentions a fatal case. Marshall believes that these cases may perhaps have been due to an insoluble preparation of the drug having been used, and that it is possible that the drug when used in solution may

cause fewer accidents than when used in suspension. Nevertheless, as he states, it by no means follows that the drug remains in a state of solution in the tissues of the body after injection. He finally refers to the statement of Sir Jonathan Hutchinson of the possibility of salvarsan giving rise to arsenical cancer. Marshall after these criticisms concludes as follows: "Even if the administration of salvarsan was free from dangers and inconveniences, there appear to be few indications for its employment in the treatment of syphilis, but the dangers and inconveniences seem to outweigh any possible benefit to be derived from it."

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*Balantidium Dysentery.*—Bowman, in the *Philippine Journal of Science* for April, 1911, reports a case of dysentery caused by the *Balantidium coli*. Another interesting point in the case was that the spleen showed a patchy hæmorrhagic condition, filarial embryos being found in these areas. In his summary of this case Bowman states that during the past three years he has seen ten cases of infection with *Balantidium coli*. Two of these terminated fatally, while the others had no symptoms other than an occasional diarrhœa. Even in the severe infections, the diarrhœa was more or less intermittent in character, the parasites being found in the fæces only during these attacks. The manner of primary invasion Bowman states is not determined. It has not so far been determined whether the mucosa must be injured before the parasites can enter or whether they in themselves are capable of piercing the uninjured mucosa; attempts to infect monkeys were always unsuccessful, many different methods being tried. The presence of the filarial embryos in the hæmorrhages in the spleen, as Bowman himself admits, was probably only a coincidence. It would have been interesting to have determined whether or not they were abundant in the blood of the peripheral vessels or in the other internal organs. So many cases of this *Balantidium* dysentery have now been reported that one must always consider it as a possibility in the diagnosis of tropical dysentery. An examination of the fæces will give the clue to the diagnosis at once.

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*Sleeping Sickness.*—"The Nyasaland Protectorate Sleeping Sickness Diary," part xiv., gives details of 45 cases of sleeping sickness. Most of the first ones are now dead, and in most of the later cases the prognosis seems hopeless, another indication of the virulence of the epidemic. Dr. Sanderson is now building a sleeping sickness camp at Ngani Hill, which is in the centre of the infected district, but is itself fly free. All cases are being sent to him and are treated with atoxyl. Salvarsan is to be tried later. Dr. Drew, who has joined Dr. Sanderson, is engaged searching for cases and examining blood slides brought in from the Dedza district. The proclaimed area has been re-defined and a broad hoed path will be cut round it a mile outside the *morsitans belt*. Dr. Barclay, who edits the report, considers that the most serious point to note at present is the occurrence of three cases on the south-west arm of Lake Nyasa. He has feared that this district was infected for some time, and he has heard that the country between Kasankas and Dowa will also provide cases. Further, as there is a continuous belt of fly from Kasankas down to Matope, and as fly appears to be encroaching steadily on new areas, other cases are almost certain to be found later in the south. This will be tested when more medical officers arrive. It has also been decided to build another sleeping sickness camp in the South Nyasa district in a fly-free spot; this will be near Mpembas, and will be commenced as soon as the new medical officer arrives.

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*Cultivation of the Treponema Pallidum.*—Noguchi, of New York, reports in the *Journal of the American Medical Association*, July 8, 1911, that he has cultivated the *Treponema pallidum*. For cultivating he used the spirochæte containing testicular tissue of the rabbit, all previous investigators having used syphilitic tissues for their cultivations. The only suitable culture-medium which he has thus far found is serum-water (sheep, horse, rabbit) to which a piece of sterile rabbit tissue is added. He prefers the kidney or testicle. Test-tubes 20 cm. high and 1.5 cm. wide are chosen, into which 16 c.c. of the serum-water are introduced. After sterilization at 100° C. for three successive days a small piece of the freshly removed organ is added. The tubes, having been incubated at 37° C. for two days, are, if sterile, ready for use. A layer of paraffin oil is poured into each tube to shield the medium from the air and to prevent evaporation. In order to obtain the first growths of the spirochætes, no agar or gelatine should be added to the medium; later generations can, however, be secured in a solid medium. At first, strict anaerobiosis is required, but later this strictness is not essential. Indeed, certain strains of the treponema grow in later generations in a deep serum agar culture in which the tissue is placed at the bottom which is merely covered with paraffin oil. In no case did any of the strains grow in the absence of tissue. In this respect they differ greatly from those described by Mühlens and Hoffmann, which grew readily not only in the absence of tissue but even of serum.

In almost all the first growths, the treponemata are mingled with bacteria, and as they do not grow at this time in solid media, purification is difficult. Noguchi obtained this by permitting the organisms to grow through Berkefeld filters that hold back the ordinary bacteria for a longer period. This is accomplished after about the fifth day. Or the strains which, after a time, begin to grow in solid media may be separated from the bacteria by reason of the fact that while the latter remain confined to the stab-canal the former penetrate, as a slight haze, into the surrounding medium, from which they can be removed in a pure state. Thus culti-

vated, the morphology is correct for the *Treponema pallidum*, and motility is retained for some weeks. As would be expected from the conditions of growth, special arrangements and groupings of the organisms occur in the cultures. As regards pathogenicity two strains of pure treponemata cultures inoculated into the testicles of rabbits have set up typical lesions. Noguchi, therefore, believes that he has cultured the *T. pallidum* in pure culture and that the cultures possess the usual pathogenicity for rabbits. The method will be described in detail in a forthcoming number of the *Journal of Experimental Medicine*.

## NOTICES.

THE Managing Committee of the Sleeping Sickness Bureau has decided to publish from the Sleeping Sickness Office at the Royal Society, Burlington House, W., a quarterly *Bulletin* dealing with the *Leishmania* group of diseases. Dr. C. M. Wenyon, Protozoologist to the London School of Tropical Medicine, will undertake the work. A list of references is now in preparation and will form the first number. Those who wish to receive the new *Bulletin* should send their names to the Director; the latter will be glad to have copies of publications on the subject for the Bureau library.

## Correspondence.

WE reprint the subjoined letter from Surgeon Lt.-Col. Oswald Baker, I.M.S. (retd.), which appeared recently in the *Rhodesia Herald*, a paper published in Salisbury, Rhodesia. Such a state of affairs is deserving of wide publicity, and Dr. Baker has only done his duty in bringing the matter before the public. It is sincerely to be hoped that his letter may ultimately be the means of having this foolish tax abolished.

### THE TAX ON QUININE.

(To the Editor of the *Herald*.)

Sir,—In the latter part of the year 1909, being then in England, I sent my son, at that time a young settler on the Premier Estate, Umtali, some quinine to protect him against infection with malaria, and I was astonished beyond measure to learn he was charged duty on it.

I wrote to the British South Africa Company in London and expressed my surprise at quinine being a dutiable article in a country wherein malaria as well as its often-fatal congener, blackwater fever, were indigenous diseases, and in the reply with which I was favoured it was pointed out that the Company was a party to the Customs Union of South Africa and was therefore to some extent fettered by the resolutions of that body. I then ventured to suggest that this difficulty might be overcome by slightly staining the quinine for Rhodesia, and making stained quinine contraband in the other States of British South Africa. This ended the correspondence.

Not long ago I imported into Rhodesia two mosquito nets and was charged seven shillings duty on them.

That the administrators of a country under British dominion, which is haunted by malaria and blackwater fever, should, at the present day, maintain an import tax on quinine is inconceivable. It is the bounden duty of every civilized State to protect the lives of its inhabitants, not to contribute to their insecurity. An administration which taxes the only known specific remedy for a not-infrequently fatal disease, which is engendered within its boundaries, merits contumely. The taxes on quinine and mosquito nets are iniquitous and inhuman, and, however trammelled, or whatever the sacrifice, the Administrators of the country should repeal them without delay.

What measures has the governing body of Rhodesia adopted for the control and suppression of the malaria and blackwater fever, with which the country it rules over is infected? Is quinine distributed throughout the land for sale at the Government Post Offices at cost price, as in India; do apothecaries, headmen and others distribute quinine gratuitously in all parts of the country, as in Ceylon; is quinine given to the poor, and sold at a nominal price to those who are willing and able to pay for it, as in Mauritius; is money spent on the gratuitous distribution of quinine as a prophylactic, as in Lagos; or does the Administration offer to supply employers of labour, the miners and farmers, to wit, with the remedy at cost price for the protection against malaria of their labourers, as in British Guiana? No, and the governing body not only leaves all this undone, but, by prohibiting the free importation of quinine into the country, it fosters the persistence and spread of these diseases among its subjects. The Administration distributes "leaflets" indoctrinating the treatment for malaria and, at the same time, by raising the price of quinine, places the prescribed remedy beyond the reach of the poor and indigent!

How far the Directors of the British South Africa Company are responsible for the lives of those who have died from malaria and blackwater fever in Rhodesia only the victims of these diseases could tell. My pulses throb, and well they may, from indignation, when I think of this disgraceful tax, imposed by British Administrators on their fellow men.

But, sir, I cannot believe that the Directors in London ever realized the inhumanity of enhancing the price of quinine, otherwise this ignominious tax would surely not have been imposed. Be this as it may, the stain on the escutcheon of the British South Africa Company is there.

I am sanguine enough to hope that the publicity given to the contents of this letter, through its insertion in your columns, will lead not only to the speedy abolition of the taxes on quinine and mosquito nets, but also, if not to the free distribution

of quinine to the poor, at least to the sale of it at cost price, by the Administration, throughout the length and breadth of Rhodesia.

I am, &c.,

OSWALD BAKER,
*Surgeon Lt.-Col. I.M.S.* (retd.).

Old Umtali,
April 27, 1911.

## Recent and Current Literature.

*A list of recent publications and articles bearing on tropical diseases is given below. To readers interested in any branch of tropical literature mentioned in these lists the Editors of the* JOURNAL OF TROPICAL MEDICINE AND HYGIENE *will be pleased, when possible, to send, on application, the medical journals in which the articles appear.*

### "Lancet," July 22, 1911.

*Spirochætosis.*—Balfour gives some interesting details of experiments on feeding fowls with ticks infected with fowl spirochætes—his so-called *Sp. granulosa penetrans.* As a result of his experiments, he finds that if healthy chicks be fed on ticks (*Argus persicus*), which themselves have recently fed on birds infected with spirochætes, the chick speedily develops the disease. Not only so, but if healthy chicks be fed on a sufficient number of ticks which, having fed a long time previously on spirochæte-infected birds, harbour, not spirochætes, but granules only, these chicks likewise become infected through the alimentary canal.

In both cases the incubation period was short, in one instance it was very short. Of course, every care was taken to exclude any other possible source of infection, and Dr. Balfour thinks that his experiments prove conclusively that spirochætal infection in fowls can really take place *per os.* These observations are very interesting, and certainly support the ideas of some authors that an infection of rats with *T. lewisi* can take place by the rats eating infected fleas.

### "New York Medical Journal," July 15, 1911.

*Bilharziosis.*—Walter Baetz reports a case of rectal bilharziosis from Panama. The patient, a negro, came from Antigua, one of the West Indian Islands, to Panama four years ago. Since that time he was once treated for malaria in the hospital at Ancon, but otherwise had always been healthy.

Four days before his present admission he was seized with signs of dysentery, *e.g.*, pain, frequent bloody stools, tenesmus. This continued for some time, blood, pus, mucus and necrotic tissue being passed in abundance. After some time all the symptoms became greatly mitigated without any special treatment, and then lateral-spined bilharzial eggs were found. These in turn decreased rapidly in number, and were finally absent on the twenty-fourth day of the dysentery. All clinical symptoms by that time also having disappeared. Ankylostome ova were also present in the stool. It is interesting to conjecture where the infection was picked up. Baetz says bilharziosis is very rare in Panama, but it seems hardly likely that the patient should have acquired the infection in Antigua, and carried it about with him for four years without symptoms. One of the first cases of lateral-spined bilharzial ova from the West Indies, it will be remembered, was described as having come from Antigua by Manson.

*Sleeping Sickness.*—The Sleeping Sickness Bulletin for July, 1911 (No. 28, 1911. Vol. 3), contains some new and interesting information on Trypanosomiasis. The following is a list of its contents: (1) The Transmission of Trypanosomes. (2) Trypanosomiasis in Rhodesia. (3) Treatment of Trypanosome Infections. (4) Extrusion of Granules by Trypanosomes. (5) Trypanosomiasis of Animals. (6) Changes in the Liver in Trypanosomiasis. (7) *Trypanosoma lewisi* and mice. (8) Tsetse Flies and their Bionomics. (9) Trypanosome Forms in Cultures and other Papers. (10) Sleeping Sickness News, Nyasaland, &c.

## Personal Notes.

INDIA OFFICE.

*From July 3 to July 10.*

*Arrivals reported in London.*—Lieutenant-Colonel E. W. Hore, I.M.S., B.; Major W. H. C. Forster, I.M.S., B.; Major C. R. Stevens, I.M.S., B.; Captain W. H. Odlum, I.M.S.

*Extensions of Leave.*—Captain W. H. Oldham, I.M.S., 1 day.

*Permitted to Return.*—Major C. Donovan, I.M.S.

*From July 10 to July 17.*

*Arrivals reported in London.*—Lieutenant-Colonel W. B. Lane, I.M.S., B.; Major R. H. Elliott, I.M.S., M.; Captain D. C. V. Fitzgerald, I.M.S.; Captain A. W. Howlett, I.M.S.

*Extensions of Leave.*—Captain H. Watts, I.M.S., B., 1 month, M.C.; Captain E. C. C. Maunsell, I.M.S., 7 days.

*Permitted to Return.*—Captain H. Watts, I.M.S., B.

*From July 24 to July 31.*

*Arrivals reported in London.*—Captain H. M. H. Melhuish, I.M.S., B.; Major W. H. Cox, I.M.S.; Lieutenant A. G. Tresidder.

*Extensions of Leave.*—Lieutenant-Colonel J. Chaytor-White, I.M.S., B., 6 months.

*Permitted to Return.*—Lieutenant-Colonel W. E. Jennings, I.M.S., Bo.

LIST OF INDIAN CIVIL OFFICERS ON LEAVE (INCLUDING MILITARY OFFICERS UNDER CIVIL RULES).

*Showing the Name, Province, and Department, and the Period for, and Date from, which the Leave was granted.*

Bedford, Lieutenant-Colonel C. H., I.M.S., 6 m., April 18, 1911.

Cadell, Lieutenant-Colonel, J. M., I.M.S., U.P., 16 m., April 26, 1911.

Elliott, Major R. H., I.M.S., M., 6 m., May 8, 1911.

Forster, Major W. H. C., I.M.S., Punj., 6 m., April 1, 1911.

Foster, Captain R.

Goldsmith, H.M., Captain J. F., I.S.M.D., Burma, 12 m., May 15, 1911.

Hore, Lieutenant-Colonel E. W., I.M.S., India Foreign.

Jameson, Lieutenant-Colonel J. B., I.M.S.

Meyer, Lieutenant-Colonel C. H. L., I.M.S., Bombay, 4 m. 15 d., June 5, 1911.

Rogers, Major L., I.M.S., B. Med. Dept., 9 m., March 3, 1911.

Stevens, Major C. R., I.M.S., B. Med. Dept.

LIST OF INDIAN MILITARY OFFICERS ON LEAVE.

*Showing the Name, Regiment, or Department, and the Period for which the Leave was granted.*

Benson, Surgeon-General, R.H., C.B., I.M.S.

Brassey, Captain L. P., I.M.S., 16 m., from March 28, 1911.

Fitzgerald, Captain D., C.V., I.M.S., 1 yr., from June 4, 1911.

Howlett, Captain A. W., I.M.S., 8 m., from March 1, 1911.

Lloyd, Captain R. A., I.M.S.

Tresidder, Lieutenant A. G., I.M.S.

## Notices to Correspondents.

1.—Manuscripts sent in cannot be returned.

2.—As our contributors are for the most part resident abroad, proofs will not be submitted to those dwelling outside the United Kingdom, unless specially desired and arranged for.

3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.

4.—Authors desiring reprints of their communications to the JOURNAL OF TROPICAL MEDICINE AND HYGIENE should communicate with the Publishers.

5.—Correspondents should look for replies under the heading "Answers to Correspondents."

## Original Communications.

# THE CLINICAL VARIETIES OF UNDULANT (MALTA) FEVER MET WITH IN SOUTH AFRICA.

By ALEXANDER GARROW, M.D.Glas.

*Steytlerville, South Africa; formerly Resident Physician, Glasgow Royal Infirmary, &c.*

THIS paper is founded on an experience of Malta fever extending over three years, during which time I have been in practically daily contact with the disease or its sequelæ. I shall have occasion, however, to refer to cases which I met with in my practice in the same district during the four years prior to the above period. These cases were at the time undiagnosed. During last year I had the valuable, although unpleasant, experience of having passed through an attack of the acute one-wave type.

It gives me pleasure to acknowledge that it was the papers in the *South African Medical Record* of my former fellow-student, Dr. P. D. Strachan, of Philippopolis, that lead me to discover that Malta fever exists in this district.

Interesting papers have appeared from time to time in the same journal from the pens of Lieut.-Colonel Birt and Major McNaught, of the R.A.M.C., and Drs. J. E. McKenzie and D. M. McRae. That of the latter deals particularly with points in diagnosis.

I read Dr. Strachan's first paper in 1904, but it was not until 1906 that I diagnosed my first case. Subsequent experience has taught me that I had encountered cases between 1904 and 1906, but had failed to diagnose them, even although I was actually on the alert for the disease. The reason for this was that after reading Strachan's first paper I read up the text-book descriptions of the fever, and kept on the outlook for a case conforming to that description, and, as I have said, it was not until 1906 that I first met with such a case. I relate this personal experience for the benefit of those practising in the goat, and therefore probably infected, districts of South Africa who may think, as I did during these years, that they have not seen many cases of the disease. I did not know then what I know now, namely, that most of the cases we meet in this country are of a very chronic nature, and run, practically speaking, an afebrile course, and that it is only occasionally that one meets with the typical undulant cases. I should say that in South Africa the chronic type is endemic and that we meet with acute and undulant cases sporadically, and sometimes in epidemics.

The extraordinary variability in the behaviour of the disease may be gathered from the fact that the monograph of Hughes contains as many as eighty pages devoted to a description of the symptomatology and clinical manifestations and combinations met with. Any less complete description is inadequate for those of us who are in almost constant contact with the disease. Unfortunately the book is out of print. The clinical part of it is so excellent that one hopes that someone will think of undertaking the preparation of a new edition now that the true etiology has been discovered. A new edition is certainly needed, for of late years it has been found that the geographical distribution of the disease is much more extensive than was formerly thought. One of the latest additions is far-off Uganda. Sir David Bruce, in his speech at the last annual meeting of the Research Defence Society, stated that the Sleeping Sickness Commission, when in Uganda, had, in addition to their work on sleeping sickness, established the fact that the disease of which thousands of natives in a certain part of the country were sick, and of which more than a thousand had been reported as having died, was Malta fever.

Much information, as well as a *résumé* of the symptoms, is given by Eyre in the Milroy Lectures for 1908, which are published in *The Lancet*.

It must be remembered that I write this paper from the up-country practitioner's point of view. He is generally placed in a most difficult position with regard to his country cases. He is called to see a case on a distant farm, he gets a history which is not always clear and reliable, and from it and one examination of the patient he has to make his diagnosis and give a prognosis. Thus a point in a case once missed is missed, perhaps, for good. It behoves him, therefore, to be particularly on the alert for all the possibilities of a given case.

The question of the diagnosis of Malta fever is also of importance to the coast practitioner. Many cases go to the coast, some, perhaps, dissatisfied with the results of the treatment up country, and hopeful that there may be some truth in the prevailing idea that a change to sea air effects a cure; while others go to the coast well, and while there have a relapse.

### SYMPTOMATOLOGY.

Hughes begins his chapter on symptomatology with the following words: "So varied are the symptoms, and so uncertain the duration and course of this fever, that it is impossible to give a description to which all cases can be referred."

This variability of the symptoms precludes the possibility of attempting any systematic description of them individually and in detail in a paper like this. In the remarks which I shall make on the different types of the fever, and in the examples which I shall give, most of the symptoms will be referred to, but the purpose of this paper is to indicate the clinical varieties we meet with in South Africa, and not to attempt any exhaustive description of the symptoms.

*Tongue Appearances.*—The appearance which the tongue presents in this disease, however, is a subject upon which I should like to dwell in detail. I entirely agree with what Drs. Strachan and McRae have said as to its importance in diagnosis. I have repeatedly found that the condition of the tongue has helped me to a correct diagnosis in obscure

chronic cases presenting no other symptoms than those associated with a general breakdown in health; and, as I shall mention later, its appearance in the acute cases often helps to differentiate the disease from enteric fever.

To begin with, my experience is that in the great majority of cases the tongue of Malta fever is a moist one. It is usually large and flabby, and presents lateral indentations from the teeth. The edges and the tip are red.

It is the condition of the fur on the dorsum, however, that presents the variations which, as Hughes says, are the peculiarities of each and every symptom of the disease.

The most common condition is that one finds over the dorsum a white, glistening, moist coat of varying thickness, with pieces of viscid frothy saliva adhering here and there. The glistening, sparkling appearance is sometimes very striking.

Another common appearance is a thick white moist coat completely covering up the papillæ, but with none of the glistening appearance, and with no specks of white frothy saliva on it. The tongue sometimes looks as if a thick streak of white lead paint had been laid along the dorsum.

I think that it is most suggestive of Malta fever if, in a case of chronic ill-health, one finds a tongue corresponding in appearance to the conditions described above; and one should at once be led to examine for other signs and symptoms of the disease, and if they are not sufficiently marked to enable one to make a definite diagnosis, the blood may be submitted to the Widal test.

I have said that these tongue furs are white. The tongue coating of Malta fever is, in my experience, most often white. One sees sometimes a fur of extraordinary whiteness. However, in some cases the fur may be brown, and, as far as my experience goes, when one gets a brown tongue fur in chronic cases it is generally very thin. The condition looks as if the heads of the enlarged papillæ had been singed.

In acute and in malignant cases one may have the dry, brown, cracked tongue usually associated with enteric fever; but even in these types of the disease the tongue often remains quite moist. In fact, in one of the two malignant cases which have come within my experience the tongue remained white, moist and glistening throughout, although the temperature for the last few days ranged between 102° and 104°, and reached 108° F. before death.

Hughes's hospital experience of the disease has enabled him to give a very detailed description of the variations in the types of the temperature curves, and he gives many illustrative charts. It is seldom possible, under the conditions of South African country practice, to make such detailed temperature observations.

I include with this paper two temperature charts from my own practice, one that of a malignant case (fig. 1), the other that of a case of the one-wave type (my own attack, fig. 2).

Other prominent symptoms of the disease which I shall no more than mention, are profuse perspirations, headache, pain at the back of the neck, pains in the joints, with or without swelling of them, pain along the course of nerves, pain along the backbone, and especially in the mid-dorsal region, obstinate constipation (although less commonly there may be diarrhœa), anorexia, epigastric fullness, tenderness on pressure in the epigastric and in both hypochondriac regions, insomnia. One should lay special emphasis on the fact that the poisons of this disease seem to have a selective action on the nervous system. There is during pyrexia great nervous irritability, and after the pyrexia and in cases mainly apyrexial we get great despondency. Orchitis has been rare in this district.

*Enlargement of Spleen and Liver.*—In an analysis of the clinical symptoms in one thousand cases of Malta fever, Eyre puts enlargement of the spleen as having occurred in 51 per cent. of cases, and enlargement of the liver in 8 per cent. My experience in this district would put the latter at much higher percentage, and especially in chronic cases and in young subjects, children particularly.

### Classification of Types of the Disease.

I have given a considerable amount of thought to the question of a classification which will bring into prominence certain types of the disease which would appear to be more common in South Africa than elsewhere.

I think that every case that one is likely to meet will find a place in one or other of the following groups: (I) *Acute type*—(*a*) malignant cases; (*b*) one-wave cases; (*c*) more than one-wave, or the undulant cases. (II) *Subacute type.* (III) *Chronic type.* (IV) *Complicated,* including those cases which first come under observation on account of a complication or sequela of Malta fever, or during a concurrent illness.

The clinical manifestations in a case of, say, the chronic type, are so entirely different from those found in one of the acute varieties that, but for the Widal test, it would be impossible to believe that both patients were suffering from the same disease.

There is a connection, however, running throughout all the varieties, and the best conception of that is gained by remembering that the undulant type is what might be termed the central type. All the other types are but variations of it, depending upon varying combinations of such factors as the quantity of the virus and the virulence of it, and the state of the defence forces of the patient.

The undulatory type is characterized by "intermittent waves or undulations of more or less remittent pyrexia of variable length and number, separated from one another by periods of variable length of temporary abatement or absence of symptoms."

The acute one-wave type designates those cases characterized by simply one wave or undulation of varying length and severity, followed usually by a convalescence and recovery.

The malignant type includes those acute cases

characterized by great severity of symptoms and profound toxæmia, and generally resulting in death.

On the other side of our central type are the subacute and the chronic, in which, owing, perhaps, to a weakened virus, or a smaller quantity of it, or to more sluggish action of the defence forces of the body, the pyrexia is more or less subdued.

The cases which go to form the complicated type are in the majority of cases subacute or chronic. I have made a special type of it because of its importance in the conditions of South African country practice.

This classification is, of course, more or less artificial, but it is nevertheless useful both for purposes of description and for a better conception of the disease as a whole. But any one variety or type may pass into any other. Thus in a chronic case the fever may for some reason burst into flame and the case become of the acute, malignant, or acute one-wave types, and this wave of pyrexia may be but the first of several, and the case would then be classed as undulatory.

### Description of Types.

#### I.—*Acute.*

(*a*) *Malignant.*—The onset is usually fairly sudden, and the initial complaints are of some or all of the following symptoms: intense headache, severe pain in the muscles at the back of the neck, general pains, shivering fits, nausea, anorexia, and great thirst. The temperature remains high, the face flushed, the pulse rapid; the tongue is furred, and usually moist and white, although it may become dry, cracked and brown; the mind is often wonderfully clear; there may or may not be abdominal tenderness and distension. Abdominal tenderness, when present, is most common in the epigastric and hypochondriac regions. There is usually some degree of splenic enlargement, and also sometimes of hepatic. Constipation is the rule, with very pale motions, although there may be diarrhœa, with pea-soup motions. Pulmonary catarrh passing on to lobular pneumonia is very common. If there are remissions of the temperature, profuse perspirations accompany them.

The course of the case is usually one of increasing toxæmia, pyrexia, and rapidity of pulse, and the termination usually death.

The diagnostic difficulty is in differentiating from typhoid fever. Points in favour of Malta fever are moist tongue, rapid pulse, clearness of mind out of proportion to the gravity of the case, profuse perspirations; but when the tongue is dry and cracked, the patient delirious, and the motions loose and pale yellow, a certain diagnosis cannot be made on clinical grounds alone, and recourse will have to be had to the Widal test.

*Example: Case No.* 1.—Male, aged 22. The patient first came under observation on January 9, 1906, with the following history: About fourteen days previously he had felt "full" about the stomach, and he took a purgative and felt better. On New Year's Day, that is, ten days before, he felt bad again, and on taking his temperature in the evening he found it to be 101.8° F. He, however, kept moving about, although feeling very ill, until the 4th, when he took to bed. On the 9th he was brought into town on a wagon. His main symptoms were profuse perspirations, some general pains, and a "done-up" feeling, especially between 10 a.m. and 3 p.m. There was scarcely any headache, the appetite was gone, he had a bitter taste in the mouth, flatulent pains, and constipation. His face was not flushed; the tongue was of the moist, white, glistening variety. The edge of the spleen was palpable. No abdominal tenderness. The pulse was regular, fairly easily compressible, and its rate 116 per minute, the temperature at the time of this observation having been 103.8° F. The chart of his temperature from the 10th to the day of his death, six days afterwards, is shown (fig. 1). The temperature fell only once to below 102°, and ranged mostly between 103° and 104° F. On the 16th hyperpyrexia set in, and a temperature of 108° F. was registered before death, in spite of the many measures which were tried to lower it.

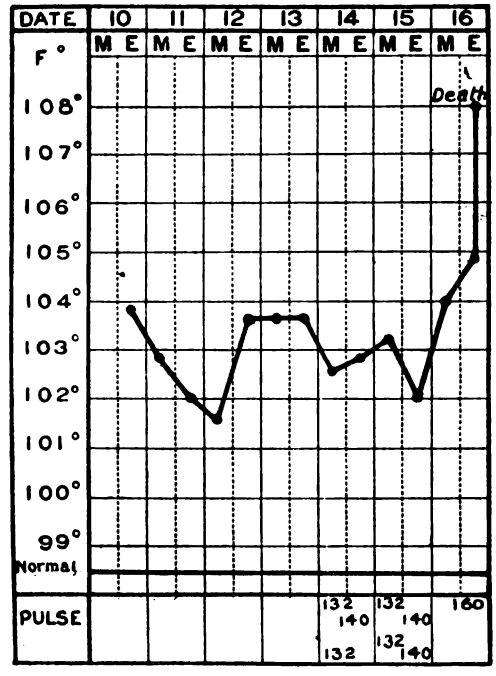


Fig. 1.

During these six days the general appearance of the patient was that of increasing toxæmia, but he remained quite conscious when spoken to until the day before his death. His tongue remained white and glistening and perfectly moist. His abdomen became very distended during the last two days, and on the day of his death he had incontinence of very foul-smelling, clay-coloured, soft, unformed motions. During these last three days the pulse-rate was about 140, and on the day of his death it rose to 160 per minute.

(*b*) *Acute One-wave Type.*—The symptoms of

this type are somewhat similar to those of the one just described, but are of much less severity, and the temperature is more remittent. The case is very like one of typhoid fever, but some of the following characteristic symptoms and signs are usually present: pains at the back of the neck, profuse perspirations accompanying the remissions of temperature, nervous irritability, a tendency to insomnia, neuralgic pains, pains in the joints, sometimes accompanied by effusion into them, a tendency to bronchial and pulmonary catarrh, and the white, moist, glistening tongue. The mental condition of the patient is generally much clearer than one finds in a case of typhoid of similar severity. The duration of the pyrexia and its manner of subsidence are similar to what we are accustomed to *in* typhoid fever.

I have seen many cases in which there has been only one wave of pyrexia. Such cases cannot be called undulatory; therefore I place them in a class by themselves. They are particularly liable to be wrongly diagnosed as typhoid fever, and one's suspicions as to the correctness of the diagnosis are not afterwards aroused, as they would be if wave after wave of pyrexia followed, as in the true undulant type.

The chart (fig. 2) shown is that of the temperature of my own attack. It looks exactly like the chart of a case of typhoid fever. The onset in my case was abrupt. I had a rigor on going to bed on the night of April 1, 1909. Next day I awoke with a severe headache, which, however, left me during the forenoon. During the afternoon I felt continuously shivery, and on the third day I took to bed. The observations on the chart begin on that day.

(*c*) *Acute More-than-one-wave or true Undulatory Type.*—This appears to be the most common type in the Mediterranean, but is not so here.

The onset is more insidious than that of the two types just described, and is characterized by such symptoms as low spirits, nervous irritability, insomnia, anorexia, nausea, headache, pain at the back of the neck, and a "creepy" feeling up and down the back. There is usually some time of the day during which the patient feels fairly well, and that is generally the forenoon. The patient does not feel ill enough to take to bed, and continues at work. After a variable time, extending to several weeks, although it may be even months, he is forced to go to bed, and he goes through an attack similar to that described under the one-wave type. A few days, however, or even one day after the temperature has subsided, it again begins to rise, and a relapse ensues, and this may occur again and again. Hughes says that the pyrexial duration of this type may extend to three hundred days or more. The anæmia, muscular wasting and weakness which result from a succession of relapses may be extreme, and when there is much pulmonary catarrh the picture presented is that of the last stages of phthisis. Unlike the patient in the latter condition, however, the Malta fever patient in this stage is extremely despondent about his condition. Finally, however, the

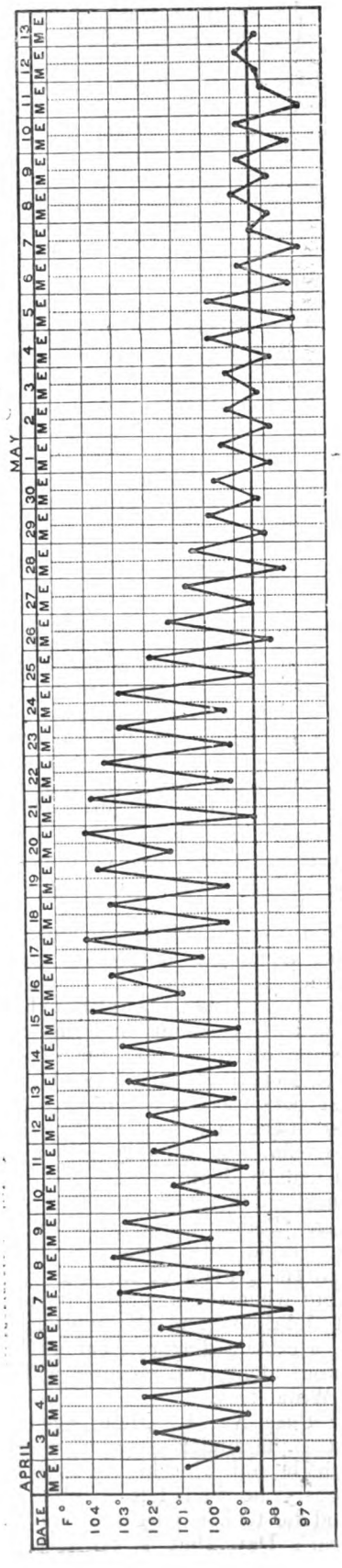


FIG. 2.

pyrexial waves cease and the tongue begins to clean, and convalescence begins. Neuritis, joint pains with or without effusion, dyspepsia and nervous palpitation are particularly common for a long time after recovery from this type.

The temperature chart of a case of this type illustrates well the definition which I have already given of this type of pyrexia, which is slightly amplified from Hughes, namely: "It is characterized by intermittent waves or undulations of more or less remittent pyrexia of variable length and number, separated from one another by periods of variable length of temporary abatement."

### II.—*Subacute Undulatory Type.*

In this group are placed those cases which are considerably milder than the type described last, and in which the periods of apyrexia would seem to be longer than those of pyrexia. In general practice, however, in this country, one has little opportunity of making definite and prolonged temperature observations in cases of this type. Country patients are usually seen during the apyrexial period, and are generally not ill enough during the pyrexial period to think of sending for a doctor; in fact, during the pyrexial period the patient may not even be confined to bed, although the afternoon temperature may be as high as 103°, or perhaps over it. A very usual occurrence is that after the first pyrexial wave has subsided the patient comes in from the farm with a ready-made diagnosis of influenza, and thinks that a tonic will put him right. If the true significance of such a case is not at once recognized, and appropriate treatment not instituted, the patient will return to his farm and find that this attack is probably the first of many, and a more or less prolonged period of ill-health will ensue, with varying combinations of symptoms, complications, and *sequelæ*. A careful inquiry will elicit information about the premonitory stage of symptoms already referred to, and an examination of the patient will perhaps reveal suggestive tongue appearances and splenic or hepatic enlargement. But there is nothing like submitting a few specimens of blood from cases of this type, and of the chronic type, to the Widal test, to make one realize how many cases there are of this kind, and how often one has missed them in the past. All blood examinations from my cases have been performed at the Government Bacteriological Laboratory presided over by Dr. Robertson, to whom I express my thanks for the help obtained.

### III.—*Chronic Type.*

It is fairly common to come across cases presenting varying combinations of the usual symptoms and signs in people who still continue at their ordinary occupations throughout the whole trouble, and who do not seem to have any pyrexia at any time, although one cannot make definite statements on that point, because prolonged and frequent temperature observations are not made on these patients. Cases belonging to this type may be missed under such diagnoses as dyspepsia, anæmia, neuralgia, refraction headaches, chronic rheumatism, general debility, &c., &c.

### IV.—*Complicated Type.*

This group is formed to include those cases which have developed some complication the symptoms of which are the predominant features when the patients *first* seek advice, also those chronic Malta fever patients who are seen for the *first* time during a concurrent illness.

The subacute and chronic types are by far the most common in a district like Steytlerville, and they are the types which furnish cases coming for the first time under observation on account of a complication, a sequela, or a concurrent illness.

It is of the greatest importance to recognize the Malta fever element in these cases, so as to be the better able to give a more reliable prognosis. If this is given without taking into account the Malta fever element, and simply on what we know of the usual behaviour of the given complication when it occurs as a primary disease, later events are not likely to turn out always according to predictions.

In these cases the predominant symptoms are those of the complication, whatever they may happen to be, but in all of them a close inquiry will reveal that there was a previous period of ill-health with the usual symptoms in varying combinations, and it is only by a concentration of attention on these symptoms, and following up the clues which they give, that one is led to examine carefully for Malta fever signs and symptoms, and is saved from making an incomplete diagnosis.

When an attack of Malta fever follows immediately after some acute illness, it often causes anxiety and trouble, if undiagnosed. For instance, just lately I had a case of measles in a girl aged 12. After recovery from the measles, she developed an illness characterized by general pains, constant coughing, drenching sweats, remittent pyrexia, and the physical signs of broncho-pneumonia. One's first thoughts, naturally, were of that fatal sequela of measles, acute pulmonary tuberculosis. It turned out, however, to be a case of acute one-wave Malta fever of three weeks' duration. I wondered at the time if she had been infected by that abominable treatment of measles which is so frequently adopted, namely, swallowing copious draughts of a tea made from goat's dung.

I have chosen the following cases from my note-books as exemplifying the great variety of cases which belong to this group.

#### *Pulmonary and Pleural Cases.*

*Case* 2.—Male, aged 50, farmer, July 8, 1908.—I was called to see this patient to-day on his farm, thirty-two miles away, and was informed that some days before he had been seized with a severe pain in the right side, aggravated by coughing. Mustard plasters and hot poultices had been applied, and had brought considerable relief. Further inquiry elicited the fact that his health had been distinctly deteriorating for some months. He had been getting emaciated, his appetite was gone, he had been becoming more and more unfit for his work; every afternoon he had complained of feeling chilly, and, as he had a cough,

he was generally supposed to be developing consumption. When I saw him he had an anæmic, thin, and haggard appearance, his tongue was thickly coated with a white, moist, glistening fur, his pulse was 90, temperature (afternoon) 101°, and respiration 20 per minute.

Examination revealed dulness, loss of vocal fremitus and of vocal resonance, and a diminished tubular respiratory murmur over the lower half of the right side of the chest, back and front, and depression of the liver, which was palpable and tender.

The diagnosis of pleurisy with effusion was made, and it was thought to be secondary to Malta fever, and blood was taken, tested at the Government Laboratory, Cape Town, and found to react positively at a dilution of 1 in 100.

July 14, 1908.—Seen on his farm to-day; practically no change.

July 19, 1908. — Seen again to-day. Patient's general appearance better, but the physical signs in the chest unchanged.

August 25, 1908.—After an interval of five weeks I was called to the farm to-day. I was informed that he had been progressing fairly favourably, one day better and the next day not quite so well, until about four weeks ago, when, after a severe fit of coughing, he brought up a lot of very foul-smelling pus. Indeed, for days afterwards the smell in the room was such that his nurses could scarcely bear it. This expectoration of greenish-yellow pus has continued. Careful physical examination of the chest revealed no change in the physical signs, but it was thought that the pleural effusion had become purulent, and his removal to Uitenhage hospital was advised.

This advice was followed within a week, and he was there operated on, and a large quantity of pus was evacuated from the right side of chest. After that his progress was good, and some time later he returned to his farm with a discharging sinus.

The sequel was very unfortunate. In December of that year he returned to Uitenhage Hospital to have another operation performed, and died while being put under the anæsthetic.

*Case* 3.—Female, aged 61, farmer's wife. August 13, 1908. To-day I was called to the farm, twenty miles distant, and found her to be suffering from right apical pneumonia, with a profuse herpetic eruption on the lips.

Fortunately I had seen this patient shortly before, when she was suffering from severe pain in the left hip, of ten days' duration, and sometimes of agonizing severity. The associated symptoms and signs were: haggard, thin appearance, thickly furred, white, moist, glistening tongue, pain on deep pressure over the left gluteal region, general abdominal tenderness, a tender liver, the edge of which was palpable 2 in. below the costal margin, and a history of insomnia, constipation and sweats for some time previously.

The blood was tested at Cape Town, and found to react positively at a dilution of 1 in 500. The pneumonia terminated by crisis on the sixth day. I saw her the day before the crisis, when she appeared to be *in extremis*. She gradually and slowly improved after recovery from the pneumonia, but the hip pain persisted. During September I was informed that she had a relapse of the Malta fever symptoms, but I did not see her. Her condition remained in a very unsatisfactory state, but the family, who had seen a fair amount of Malta fever amongst their neighbours, considered that all her symptoms were due to that. On January 2, 1909, however, I was asked to go out to see her. Her symptoms were now severe, and constant pain in the abdomen, and a "lump" there. Examination revealed a large, nodular, very tender mass filling up the right half of the abdomen down to the level of the umbilicus. I diagnosed it as malignant, and probably hepatic in origin, but I had only the one opportunity of examining it. She died three days later.

*Hepatic Cases.*

*Case* 4.—Male, aged 60, farmer, May 19, 1908. To-day I saw this patient on his farm, fifty miles distant. He had first taken to bed on March 28, on account of pain under the right costal margin, which was fairly continuous in character, with acute exacerbations. He remained in bed for seventeen days, during which the chief symptoms were feverishness, severe headache, and sleeplessness, in addition to the symptoms associated with the hepatic region. He recovered somewhat, and got up, but had a relapse, with similar symptoms. This lasted some ten days, and he again got up. Yesterday, however, he had a sudden seizure of this pain, and I was sent for. I saw him at 3 p.m., when the temperature was normal and the pulse 80. The tongue had the typical white, moist appearance. There was some conjunctival icterus. The liver was enlarged, smooth, and tender, and its edge distinctly felt 3 in. below the costal margin. The urine was bilious, and the fæces pale. Some blood was taken, which, when tested at Cape Town, reacted positively at a dilution of 1 in 25.

During the following week he was removed in a wagon by easy stages to the village, which he reached on May 31. During that night I was summoned, and found him suffering from typical hepatic colic, which was subdued by opium. His physical condition was as noted on the 19th of the month, except that he was much thinner and markedly anæmic, and that he complained of pain in the right side and back, just above the hepatic region, where, on auscultation, some creaking friction was audible. From May 31 to July 18 he remained under constant observation in the village. During that time he spent the first five weeks in bed between blankets. He had no recurrence of hepatic colic, and his progress was continuous, but very slow. The enlargement of the liver slowly subsided, the motions and urine assumed gradually their normal colour, and the icterus disappeared. Towards the end of the period of convalescence, rheumatic pains without effusion supervened, and caused great discomfort. They were confined chiefly to the finger-joints, but at times the larger joints were also painful.

On August 10 I had an opportunity of seeing and examining him. His colour had much improved, as well as his strength, but he was still more or less a

martyr to rheumatic pains. Physical examination was quite negative.

On April 27, 1909, this patient was brought into the village on account of severe pain in the cardiac region. I was then in bed suffering from Malta fever, and my brother saw him, and found loud pericardial friction. Counter-irritants were applied, and potassium iodide administered, and the condition soon subsided. Since then the man has had no medical attention. I see him often, and he looks hale and hearty.

*Case* 5.—Female, aged 32.—The following case came under my observation in those days before I had learned that the variety of clinical conditions which may be met with in a case of *Micrococcus melitensis* infection is rivalled only by that met with after *Spirochæta pallida* infection.

I made no diagnosis at the time, and took full notes in the hope that some day I might be able to clear it up. Now I am certain that the liver condition was secondary to Malta fever.

The patient was brought into the village from a farm on March 25, 1908, complaining of intermittent pains in the hepatic region, with jaundice and indigestion. She had been married for fourteen years, had had eight children, the youngest one a year old, and weaned nine months before. The only previous illness was enteric fever when very young.

Four years ago she was suddenly seized with severe pain under the right costal arch, which lasted in the severe form for a day. She took to bed, and the pain gradually subsided, and she was quite well in about nine days. This attack was not accompanied by any change in the colour of the skin, the conjunctiva, the urine, or the fæces. From then until one year ago she was quite well. One year ago she had a return of the same pain, next day she was jaundiced, and the urine was brown, and the motions pale. During the last year she has had these attacks off and on. They are sudden in onset, accompanied by a feverish feeling, sometimes by vomiting, but never by rigors. The jaundice has been constant for a year. In addition, she has epigastric fulness, especially after meals; the bowels are more inclined to looseness than otherwise.

*Present Condition.*—Skin dark yellow; conjunctivæ markedly yellow; mucous membranes anæmic; fairly thin. Pulse normal in character and 88 per minute. Tongue clean; a few decayed teeth, but none of them badly so. On inspection of the abdomen, it was found to bulge more on the right side of the umbilicus than on the left, and on palpation this was found to be due to a mass filling up the right half of the abdomen from the costal margin to the level of the iliac crest. It was smooth, and only tender to pressure at the upper part. That this was an enlarged liver was easily demonstrated by passing the fingers below the lower margin of it, and grasping the edge of it between one's fingers and thumb, just as one can often do that of an enlarged liver. In the same way the notch between the two lobes could be easily traced out. There were no signs of ascites. The patient remained under observation for five weeks, and went home feeling much better, but still somewhat jaundiced. I saw her again about a year afterwards, when she looked the picture of health, and was suckling another child. Her liver was still palpable about 2 in. below the costal margin. I know of no other possible diagnosis than that the liver condition was due to Malta fever. I have not read of any disease associated with such profound jaundice and such tremendous enlargement of liver, and followed by gradual return to perfect health.

If such a case were to occur in the Tropics, where Malta fever is common, as has been proved, and if it were to come under observation during a pyrexial wave with drenching sweats, I can imagine that it could easily be diagnosed as hepatic abscess, and pus looked for.

*Kidney Cases.*

The two following cases occurred in the early days of my Malta fever experience, and gave me considerably greater difficulty in diagnosing them than they would now:—

*Case* 7.—Female, aged 18, shop assistant. I was called to see this girl on August 29, 1908. About a fortnight previously she had had tonsilitis with general pains and malaise, but no rash. She had been in bed for a week, and after getting up she went at once to her work in a store on a cold, raw day. On August 25 her relatives noticed that her eyelids were puffy, and since then the œdema had become general. When I saw her, it was after she had been a day in bed again. Her eyelids were puffy, there was no œdema elsewhere, the tongue was clean, the temperature normal, pulse regular, of high tension, and its rate 80 per minute. Heart signs were normal. Urine was scanty, with specific gravity of 1016, and was loaded with albumin. The deposit contained much epithelial débris and a few hyaline and granular casts. The ophthalmoscopic appearances were normal.

A diuretic was given, and the patient put between blankets, and hot-water bottles applied to promote the action of the skin. For the next three days she had most profuse perspirations and severe headaches. The former I considered to be due to the treatment pursued, and the latter uræmic in nature—both wrongly, as the sequel will show. The œdema disappeared, and she gradually improved. Almost daily examinations of the urine showed that the albumin was gradually diminishing, so that at the end of ten days there was just a cloud. On no subsequent examination of the deposit were tube casts found. The daily amount of water was also registered, and found to vary between 24 and 48 oz.

She was kept to the house for another fortnight, improving gradually, when, without permission, she went out for a drive in fairly cold air. Next day her urine was quite "thick," and on the next, *i.e.*, October 1, it was quite red. I was hurriedly sent for. The urine was as bright red as weak claret, and loaded with albumin. The deposit contained no casts and no red blood corpuscles, that is to say, the condition was one of hæmoglobinuria. She was kept strictly in bed. Her only complaints during the next two or three weeks were intermittent epigastric pains of a crampy nature. On examination, nothing but

tenderness on palpation there was made out. The condition of the hæmoglobinuria was for the first few days intermittent, *i.e.*, one day the urine would be very red, and the next day only smoky. Indeed, this difference in degree was noticed even in the course of one day. The kidney and bladder regions were thoroughly examined, with negative results, no evidence of tumour being found. There was nothing in the history to suggest calculus.

I came to the conclusion that the illness from which she had suffered a fortnight before I was first called in was "scarlatina sine eruptione," that she had developed nephritis, and that it was one of those rarer cases of Bright's disease in which one gets attacks of hæmaturia now and then. Based upon such a diagnosis, my prognosis was necessarily gloomy, and caused a considerable amount of unnecessary suffering to the relatives, as after events showed.

During one day early in October, when on my round of visits, I happened to visit this patient immediately after having visited a case of acute Malta fever, whose blood gave positive reaction at a dilution of 1 in 1,000. During the usual routine examination I looked at her tongue, and was struck with its great similarity to the tongue which I had just seen in my last patient, and began to wonder if I had to deal with a condition secondary to Malta fever. I at once took some blood and sent it to Cape Town, where it reacted positively at a dilution of 1 in 700.

The patient made a gradual slow recovery, and went away for a change of air. Since her return she has continued regularly to attend to her duties in the store.

For purposes of this paper I examined the patient's urine on September 16, 1910, and found it to be normal.

*Case* 8.—Male, aged 35 ; farmer. This patient had suffered periodically for about four years in the following manner. He would first lose his sense of well-being, and in a few days headaches would supervene, and then pain in the lumbar regions, especially the right. The latter was of a dull character, passing down in the direction of the right ureter into the right testicle, and down the inner side of the right thigh ; it was never of a colicky nature, and was never accompanied by any peculiarity in the water, or in the act of micturition. In addition, at these times he would suffer from dyspepsia and flatulent distension. The duration of these symptoms was generally a few weeks, and similarly the intervals of freedom from them.

Complete notes of an examination made on July 31, 1908, were taken, and the following is a summary of them : Tenderness on gentle palpation in epigastric region. Deep palpation discovered a smooth and tender liver extending 1½ in. below xiphoid cartilage in the middle line and half an inch below the costal margin in the nipple line. Deep palpation in the right renal region discovered a smooth and tender "lump" corresponding in every way to an enlarged kidney. Deep palpation in the left renal region discovered a similar structure, but not so distinctly. The urine was normal. The patient was being severely handicapped in his attention to extensive farming interests by the worry associated with the above recurring symptoms, so on the above date I advised him to go to Port Elizabeth for another opinion. Before he had made arrangements to follow that course, however, the case last narrated suggested to my mind the advisability of having his blood submitted to the Widal test. This was done, and the result was positive at a dilution of 1 in 300.

The effect of having a positive diagnosis of his condition had an excellent mental effect, and enabled the patient to put up with the symptoms more cheerfully. I think that he had been haunted by a fear of an abdominal "tumour."

I am inclined to the view that his symptoms during these few years were due to *Micrococcus melitensis* infection, and that the kidney enlargement had a similar origin. My experience is that when *M. melitensis* infection produces very little pyrexia, it produces symptoms which may last off and on for years.

*Nervous Cases.*

*Case* 9.—A Hottentot woman, aged about 60, came to see my brother, during my illness, on account of the condition of the right eye. He found ptosis of the right upper eyelid, dilation of the pupil and external strabismus, *i.e.*, signs of paralysis of the third cranial nerve consequent, evidently, on a neuritis of it. The typical moist, white tongue suggested an examination for other signs of Malta fever. None were found, and blood was taken which reacted positively.

This woman has not had any acute waves.

I have lately had a case in a child, aged 2, where facial paralysis developed. Her blood reacted positively.

*Case* 10.—Male aged 20. This lad was carried into my surgery by his brother late on the evening of April 15 last on account of spasms which had begun about an hour previously. He was laid on the couch, and I found violent clonic spasms of the right quadriceps extensor muscle to the number of two hundred a minute. The head was being also spasmodically jerked to the right. A quarter of a grain of morph. sulph. was injected hypodermically and the lad carried home and put to bed. He had at intervals through the night several attacks ; I was sent for to see him in a particularly severe one. He never lost consciousness, and the facial expression was the picture of nervous distress. The above was the method by which an acute one-wave attack of Malta fever was ushered in. His blood reacted positively at a dilution of 1 in 60. After that first night he had no recurrence of the spasms, although for a few days he had to be kept very quiet in a darkened room because he said that he had a constant feeling in his right inguinal region as if the spasms were going to begin—a feeling which seems comparable to the aura of the epileptic.

*Cases Simulating Hip-Joint Disease.*

*Case* 11.—Female, aged 7. On April 26, 1905, I saw what I took to be the first case of tubercular hip-joint disease which I had encountered in this country.

The following are particulars from notes made at the time:—

"Patient stands with right leg rotated inwards and adducted, and with knee flexed; walks with leg in similar position and with a lordosis. Lying on back, the left leg is 1⅜ in. longer than the right. Lateral movement of the right leg moves whole pelvis along with it, while left leg can be moved from side to side with pelvis stationary; right knee cannot be flexed on chest; extending right leg flat on couch produces a lordosis; right leg somewhat wasted; right gluteal muscles flattened; knee-jerks exaggerated on both sides."

The child was taken out to the farm on the same day, and no special treatment pursued. I met her some months afterwards, and was astonished to find her gait and hip-joint normal in every respect, and she has remained well ever since. The case remained a mystery to me until I had made a closer acquaintance with Malta fever and its effects.

That I have erred in good company is evident from the following case:—

*Case* 12.—Female, aged 3. During 1908 the mother of this blue-eyed, fair-haired and pink-and-white complexioned child was under my care suffering from incipient phthisis pulmonalis. At her visit to see me, on December 24, she mentioned that the child was complaining of pain in the left hip-joint. A rather cursory examination discovered nothing to account for it. During January I was told by an uncle of the child that she could scarcely walk, and limped about with the leg flexed at the knee. During February the mother went to the coast to have another opinion about her lungs, and at the same time the child was taken to a gentleman who had special qualifications in surgery. He diagnosed commencing tubercular disease of the hip-joint, and kept the child under his personal treatment by lying in bed with extension applied to the leg. I got these latter particulars from the parents on March 17, 1909, *i.e.*, about ten days after they had returned from the coast. I happened to be on the farm that day, and took the opportunity of making a thorough examination of the child. I found all the movements of both hip-joints to be perfectly normal, the legs to be equal in length, and the gait to be normal. The liver, however, was palpable 2 inches below the right costal margin, and the spleen half an inch below the left. I took blood which reacted positively at a dilution of 1 in 150.

The child has remained well, although the mother unfortunately died of the phthisis pulmonalis in the early part of the year.

August 20, 1910.—On this date, and while this paper was being prepared, this child was brought to me with the history that for three weeks she had been off her food and her games, and had been sleeping restlessly. For two days the water was noticed to have been very dark. She was very pale, but there was no œdema. The tongue was coated with a dry, yellowish-white fur. The spleen was not enlarged, but the edge of the liver was felt about an inch below the costal margin. The urine was blood-coloured and loaded with albumen.

September 6, 1910.—Urine examined to-day was found to be of a dirty yellow colour, with a specific gravity of 1007. It had a distinct precipitate of albumen, and the deposit showed granular and blood casts in fair abundance, as well as renal epithelial cells, leucocytes, and red blood-corpuscles.

It is evident that the *M. melitensis* in this case have been lying dormant during the interval of good health.

The renal condition would appear to be very similar to that which existed in Case 7.

*Injuries, Operations, and Confinements in Patients Suffering from Chronic Malta Fever.*

*Case* 13.—On April 10 last a little coloured boy, aged about 8 years, was brought into the village suffering from a compound fracture of the left femur and severe laceration of the left foot, the result of a wagon accident.

After he had been under care for a few days the temperature began to rise. There was nothing discoverable at the sites of the injuries to account for this, but a general examination revealed signs of Malta fever, and his blood reacted positively at a dilution of 1 in 35. That discovery relieved one's fears of septic infection of the compound fracture. By the time that the latter had healed sufficiently to permit of the lad leaving his bed the pyrexial wave o the Malta fever had also subsided.

*Case* 14.—On January 14, 1910, a huge testicular tumour of some seven years' standing was removed from a man aged 40. Everything went well with the patient and the wound for ten days, when a subacute attack of Malta fever with pleural effusion developed.

This patient died suddenly some weeks after returning to the farm. I had no opportunity of ascertaining the cause.

Dr. Strachan, in his latest paper on Malta fever, mentions that when this fever complicates the puerperal state grave apprehensions of septicæmia are apt to arise. I remember having such a case in the days when I was unacquainted with Malta fever. It gave much anxiety, and puzzled me not a little.

In the above three cases I take it that each patient was suffering from chronic infection with the active symptoms and signs held in check. In the one case the injury, in the other the operation, and in the third the confinement, upset in some way the equilibrium between attack and defence which had been maintained until then.

The above cases will suffice, I hope, to demonstrate that the South African practitioner must be prepared to meet with *M. melitensis* infection under extraordinary disguises. Other illustrative cases, the symptoms and signs of which centred around other organs, might also have been given.

## Duration.

There are two points connected with this question, namely, the pyrexial duration and the duration of the period of ill-health.

Hughes gives the average pyrexial duration of 372

cases as fifty-eight days. My impression is that the average pyrexial duration of South African cases is much less. On the other hand, subacute and chronic cases may take years to get rid of the effects of the disease.

### Prognosis.

Hughes puts the case mortality as 2 per cent. in the Mediterranean. It is even less in South African practice, where one has more subacute and chronic cases than would be met with in hospital practice in Malta. As far, therefore, as mortality is concerned, the prognosis is favourable. It is quite otherwise, however, when one comes to consider the question of the after-effects. Some of them constitute a serious menace to life itself. That, however, is fortunately exceptional. A serious aspect of the prognosis of the after-effects is the great length of time that some of the cases take to regain their former state of health, and the tendency in the subacute and chronic cases to have apyrexial relapses of some of their symptoms, not sufficiently severe, perhaps, to incapacitate the patient from work, but bad enough to interfere greatly with his or her comfort.

Some of the cases described in the paper show that in many apparently serious conditions when it has been established that the diseased condition is secondary to *M. melitensis* infection the prognosis becomes improved thereby.

Generally speaking, the more sudden the onset and the more acute the pyrexia, the shorter is the duration, and the greater the freedom from after-effects.

### Recurrences.

These must be discriminated from relapses, but how that is to be done appears to me to be rather difficult. An attack brought on by a return to activity of micrococci which have lain dormant somewhere in the system, for years perhaps, must be called a relapse rather than a recurrence. While Eyre states that records of authenticated second attacks are very rare, he cites his own case as proof that they do occur. There was an interval of two and a half years of perfect health between his attacks. The second attack followed on taking part in the cleansing of a laboratory in the dust of which *M. melitensis* were found.

When in London last year, I heard of a case of a second and fatal attack, in a lady, which occurred in Ireland ten years after she had left Malta, where she had had her first attack. This must have been due to a return to activity of micrococci which had remained dormant somewhere in the system of the person during all these years, and analogous to what we get in tubercular infection.

### Sequelæ.

This part of the subject is so very important to us as South African practitioners that I shall not attempt to deal with it in a small paragraph at the end of this paper.

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## PEMPHIGUS CONTAGIOSUS.

By Lieutenant-Colonel R. H. Castor, I.M.S.,
*Burma.*

As neither Manson nor Castellani mention Burma in the geographical distribution of this disease, I wish to point out that it is fairly common in the hot weather in this country. I recently came across six cases in one family with the following history:—

*Case* 1.—Mrs. H., aged 30, first noticed the eruption on April 28, 1911, on the back of her right forearm and about the middle. When I saw it the vesicle had burst and was drying up.

*Case* 2.—E. H., aged 10 months, male. Two days later the vesicles appeared on her child; about the forehead there were several of them. They then extended to the face, upper part of chest, and the front of the right forearm.

*Case* 3.—F. H., aged 9, male, was attacked three days later, and they first appeared on the abdomen; then a few showed themselves at the root of the neck, and only one vesicle appeared on the right cheek.

*Case* 4.—C. H., aged 3, female. In this patient the eruption appeared practically on the same day as Case 3, and first showed itself on the lower part of the chin; then a few appeared on the forehead and forearms.

*Case* 5.—F. H., aged 12, female. In this case the eruption appeared on the chin, and then extended to the forearms. It appeared two days later than Cases 4 and 5.

*Case* 6.—G. H., aged 6, male. It appeared on the same day as Case 5. The disease first showed itself on the chin, and there was only one other vesicle on the wrist.

### Remarks.

(*a*) It will be seen that in three of these cases the eruption first appeared on the chin; in one it appeared on the forearm, in another it appeared on the abdomen, and in the infant on the forehead. The usual places, like the crutch, axilla, &c., were not attacked.

(*b*) The course the eruptions followed was the usual one. The sizes of the vesicles varied from a pea to about those covering the area of an inch. They did not affect the general health of the children.

(*c*) In Case 6 there were only two vesicles, in Case 1 there were four. Case 3 showed ten vesicles, and in the others there were several. The most diffused cases were in the children aged 10 months and 3 years respectively, and in these two cases they gave rise to much discomfort and irritation.

(*d*) The cases lasted from one to three weeks.

(*e*) The treatment was cleanliness, frequent use of mercury lotion, and antiseptic powder dusting.

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# Tropical Medicine and Hygiene

AUGUST 15, 1911.


## PELLAGRA INVESTIGATION.

THE second Field Commission for the Investigation of Pellagra left London on August 10, 1911. The Commission consists of Dr. Louis Sambon, M.D., Parasitologist to the Wellcome Physiological Research Laboratories and Lecturer in the London School of Tropical Medicine, and Dr. Albert T. Chalmers, M.D., F.R.C.S., D.P.H., Registrar and Lecturer on Pathology and Animal Parasitology, Ceylon Medical College. The Commission will be joined *en route* by Professor Haase, of Memphis, U.S.A., Dr. Cole, of Atalanta, U.S.A., and Dr. Martinez, Yucatan, Mexico. The Commission assemble at Vienna on August 15, and proceed thence to the pellagra-infected districts around Klausenburg and elsewhere in Hungary, where a stay of some two or three weeks is contemplated. The next field of investigation is the Austrian Tyrol, in the neighbourhood of Rovereto more especially where pellagra is said to be widely spread. After a sojourn of from two to three weeks in the Tyrol, the next place to be visited is the Asturias, in Northern Spain. On the homeward journey the South of France may also be visited if time and opportunity allow.

The Governments of the several countries mentioned have promised a most cordial welcome to the Commission, and the scientists interested in pellagra are ready to co-operate with the British and Americans who form the party.

The money defraying the expenses of the previous Field Commission in Italy in 1910 was provided by subscriptions got together by the Pellagra Investigation Committee. The results obtained by Dr. Sambon in 1910 were so important and so encouraging that a second Field Commission was determined upon, and Mr. Henry S. Wellcome has most generously come forward and supplied the funds necessary for the work to be carried on. Mr. Wellcome has already done much for medicine, especially tropical medicine. In the Sudan the Wellcome Research Laboratory, under the able direction of Dr. Andrew Balfour, has done and is doing a great work, not only for scientific research, but an abiding good to the Egyptian Sudan generally, and in other places and in other ways Mr. Wellcome's liberality is helping to advance our knowledge of tropical diseases. We are again indebted to him for the present Commission, and we are confident that under the able leadership of Dr. Sambon and the valuable assistance of Dr. Chalmers our acquaintance with the epidemiology and etiology of pellagra will be advanced. It is well known that Dr. Sambon refutes the idea that pellagra is due to the consumption of damaged maize. His conviction is that a parasite carried by a fly—a simulium—is the factor involved. So convincing were Dr. Sambon's conclusions as the result of this visit to Italy in 1910 that many upholders of the "maize theory" of pellagra etiology have become converted to the parasitic theory of the disease. Especially is this the case in America, and the presence of Drs. Haase, Cole, and Martinez with the Commission now visiting Austria-Hungary and Spain testifies to the importance and scientific value of Dr. Sambon's contention. Many American publications uphold the parasitic as opposed to the maize theory, and several declare that the conditions met with in Italy by Dr. Sambon obtain in the United States districts where pellagra prevails.

The rapid extension of pellagra in the United States, according to recent reports, is becoming alarming, and the more the effects of this insidious complaint are studied the more acute has become the necessity for a deliberate investigation of the disease.

Dr. Sambon's previous report was stated by competent judges "to be a fine piece of scientific work," and we look forward to the work of the present Field Commission with the greatest interest.

### "Medical Record," August 5, 1911.

Rayster reports three cases of non-parasitic cyst of the spleen. A singular fact concerning these cases was that all three of the patients had had chills and that in none of them was the plasmodium demonstrated. Two of them were from so-called malarial regions, but even though this was so, it seemed unlikely that malaria had anything to do with the splenic enlargement. The first case presented a simple cyst of medium size, the second a large blood cyst, the third, the largest of all, a suppurative condition (an abscess).

## Annotations.

*Anthrax.*—Boynton in the *Philippine Journal of Science* for February, 1911, contributes a note upon anthrax in the Philippine Islands. He states that the existence of that disease there seems to have attracted very little attention, the only reference to it in print being by McMullen, who published a preliminary report on the subject in the *American Veterinary Review* (1904-1905). This investigation dealt with outbreaks which had antedated the American occupation. Some time ago Boynton's attention was drawn to a smear preparation of blood made by a live-stock inspector for the Bureau of Agriculture, this having been taken from a carabao which had died suddenly in the vicinity of a place called Taytay. The film showed bacilli, which closely resembled anthrax. Other similar cases occurring, guinea pigs were directly inoculated from these and undoubted anthrax bacilli were obtained. From these observations it was evident that anthrax existed in the vicinity of Taytay, and since the animals which were proved to have died of this disease had been pastured over a fairly large area, it became clear that the infection was by no means a rare one. Boynton could not acquire definite information as to the number of animals and the manner in which they had died in these places, so it is impossible at present to state whether the infection was recent or of long standing in the vicinity—the general opinion of veterinarians was, however, that it was of long standing, but had not been recognized as anthrax prior to that time.

*Beriberi.*—Weston P. Chamberlain contributes an interesting article to the *Philippine Journal of Science* (vol. vi., April, 1911, No. 2) on the eradication of beriberi from the Philippine (Native) Scouts by means of a simple change in their dietary. He believes that the real factors in the eradication of beriberi from the Scout organizations has been a reduction in the amount of rice consumed and the addition of a legumen. His results were obtained without the use of under-milled rice. Though this was so the Board for the Study of Tropical Diseases as they exist in the Philippine Islands still favour the polished-rice theory of beriberi production as being the one best supported at the present time by experimental evidence and practical experience in many localities, and they consider that the good results with the Scouts help to support this theory. They further feel that by adopting an under-milled grain for the Scouts more rice will be able to be used without any risk of beriberi, and that this is a very important point because many natives will always attempt to subsist mainly on rice no matter how extensive, varied or well-balanced may be the diet supplied to them. Since rice is the natural and economical diet for the Oriental native it follows that an under-milled variety of the grain will work in the direction of efficiency and economy. Chamberlain summarises his conclusions as follows: (1) Beriberi has disappeared from the Philippine Scouts (a native organization) during the last half of the year 1910; (2) there have been no sanitary improvements to account for this except the changes in diet, and there has been no corresponding decrease in the admission rate for diseases other than beriberi; (3) there has been no corresponding decrease in the incidence of beriberi in the general Filipino population or in the Philippine (Native) Constabulary; (4) the decrease in admissions for beriberi among the Scouts was clearly marked for four months before the use of under-milled rice began; (5) the decrease in admissions was well under way before the mangos, camotes and ginger root of the new ration began to be issued; (6) the decrease in the admissions for beriberi was due either to unknown causes acting coincidently with a reduction in the amount of rice used and the addition of a legumen, or was due directly to these dietetic changes. As no other reduction in admission even approaching that of 1910 has occurred since the organization of the Scouts in 1901, we do not believe that the present decrease is due to coincidence; (7) these facts do not oppose the polished-rice theory of beriberi production—on the contrary, Chamberlain believes that they support it.

*The Etiology of Beriberi.*—Fraser and Stanton, in a further report on the etiology of beriberi* conducted at Kuala Lumpur in the Federated Malay States, conclude: (1) That the occurrence of beriberi in the Malay Peninsula has an intimate relationship with the consumption of a diet of which white polished rice forms the staple. Those who consume unpolished rice or slightly polished (Native or Malay, or parboiled) rice do not suffer from the disease; (2) that fowls fed on white polished rice known to have been associated with outbreaks of human beriberi develop a form of polyneuritis clearly analogous to beriberi in its clinical manifestations and pathological effects. Other white polished rices produce a similar result. Fowls fed on unpolished rice remain healthy. These animals may therefore be employed to study the mode of operation by which a diet of white polished rice results in beriberi in man; (3) that the estimation in terms of phosphorus pentoxide of the total phosphorus content of a given rice may be used as an indicator of the extent to which such a rice has been milled or polished and therefore of its beriberi-producing power when forming the staple of a diet in man; (4) that the harmful influence of white polished rice is not due to the existence in it of a poison developed after milling. White polished rice makes default in respect of some substance of high physiological importance essential for the maintenance of health; (5) that fowls fed on white polished rice constantly develop polyneuritis in a period of three to four weeks; (6) that if the meal or polishings removed from such white rice in the process of

* "Studies from the Institute for Medical Research, Federated Malay States. No. 12: The Etiology of Beriberi." By Henry Fraser, Director, Institute for Medical Research, and A. T. Stanton, Bacteriologist, Institute for Medical Research, Singapore. Kelly and Walsh, Limited, Printers, and at Shanghai, Hong Kong and Yokohama. 1911. Price 7s.

milling be added to a diet of white polished rice, fowls remain healthy. Substances essential for the maintenance of health are therefore contained in polishings; (7) that unpolished rice which has been submitted to sterilization in the autoclave at a temperature of 120° C. for two hours will cause polyneuritis when fed to fowls. The protective substances are destroyed under these conditions. Methods of analysis involving exposure to high temperatures are therefore unsuitable for determining the nature of the protective substances; (8) that the fats contained in the peripheral layers of the grain are of no value in protecting against polyneuritis; (9) that the protective substances are soluble in 0.3 per cent. hydrochloric acid. Phytin, which comprises 32.5 per cent. of the substances so soluble, is without value as a protective; (10) that the substances are not precipitated from solution in 0.3 per cent. hydrochloric acid, on the addition of 95 per cent. alcohol in such quantity as to make the resulting mixture of proof-spirit strength, they are soluble in proof-spirit containing approximately 0.12 per cent. hydrochloric acid; (11) that the protective substances are soluble in a slightly acidulated solution containing 91 per cent. of alcohol and, exclusive of glucose, amount to not more than 11.3 per cent. by weight of rice polishings, and not more than 1.13 per cent. of the original unpolished rice grain. In this fraction are included prolamine (alcohol soluble protein) and compounds of calcium, magnesium and phosphorus.

The authors further state that these researches, which comprise an unbroken sequence of experiments beginning with rices associated with outbreaks of human beriberi, demonstrate that rice is rendered harmful by the milling and polishing process to which it is subjected in the preparation of white polished rice. In this process there is removed from the grain some substance of high physiological importance in the metabolism, the absence of which results in the production of polyneuritis in fowls and of beriberi in man when a diet is consumed of which white polished rice is the staple food. Whether these substances act by rendering other elements in the diet available for nutrition or whether they are themselves the nutritive material necessary for nerve tissues, can in our present state of knowledge only be matter for conjecture. These substances, small in amount as compared with the total of the diet, have been determined within certain narrow limits, but their exact chemical nature is still unknown. The authors could find no evidence that white rice contained a poison generated after decortication by the action of moulds or other organisms. As regards prevention they state that it is important that the polishing process if carried out at all should not extend beyond the removal of the outer skin or pericarp. Likewise cooking of rice by steam under pressure should be prohibited.

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*Inoculation by Flea-bites.*—Cranston Walker, in the *Journal of Hygiene* for July, 1911 (vol. xi., No. 2), contributes a very interesting paper "Upon the Inoculation of Materia Morbi through the Human Skin by Flea-bites." After a very carefully planned-out series of experiments he found (1) that when fleas bit through films of tuberculin, vaccine lymph and staphylococcus emulsion lying upon the human skin, no inoculation was observed in 188 instances out of 195. In six of the experiments with tuberculin, inoculation followed, which possibly was not due to the flea-bites; controls gave positive results; (2) that when the same materials were rubbed over recent flea-bites no inoculations followed; controls were positive; (3) that a very minute dose of tuberculin, such as might be conveyed by a flea's proboscis, will produce a recognizable reaction in a susceptible person.

The bearing of these results on the question of plague transmission is discussed, and Walker believes that although in no way affecting the conclusion that fleas are responsible for plague conveyance, yet the above recorded results are at variance with the view which at present meets with most acceptance regarding the mechanism by which fleas transmit that disease. Such being the case, he considers that a further inquiry is needed.

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*The Transmission of Trypanosomes.*—Dr. Bagshawe, writing in the *Sleeping Sickness Bureau* for August, 1911 (No. 29, vol. iii.), states that Dr. Kleine has informed him that he (Dr. Kleine) had received a telegram from Dr. Taute from Tanganyika to the effect that the latter had successfully transmitted a human trypanosome to monkeys by means of *Glossina morsitans*. Dr. Taute fed 670 *G. morsitans* in sixteen groups on sixteen monkeys—that is, about forty-two flies on each monkey. Six monkeys are said to have become infected. No more details than these are to hand, but if the experiments are subsequently confirmed, then a ready explanation will be offered of the spread of human trypanosomiasis in North Eastern Rhodesia and Nyassaland where palpalis is absent, and where morsitans abounds. Sufficiently strong circumstantial evidence seems to have been collected now to indicate that the latter fly is the spreading agent for these countries.

## Personal Notes.

INDIA OFFICE.

*From July 31 to August 14.*

*Arrivals reported in London.*—Lieutenant-Colonel H. C. L. Arnim, I.M.S., Bo.; Major H. M. Earle, I.M.S.; Lieutenant J. W. Barnett, I.M.S.; Major R. Heard, I.M.S., B.; Captain J. F. James, I.M.S., B.; Lieutenant-Colonel S. E. Prall, I.M.S., Bo.

*Extensions of Leave.*—Captain J. W. Little, I.M.S., B., 6 m.; Lieutenant-Colonel S. E. Prall, I.M.S., Bo., 14 days.

LIST OF INDIAN CIVIL OFFICERS ON LEAVE (INCLUDING MILITARY OFFICERS UNDER CIVIL RULES).

*Showing the Name, Province, and Department, and the Period for, and Date from, which the Leave was granted.*

Anderson, Major S., I.M.S., B., 15 m., December 7, 1910.

Anderson, Captain W. M., I.M.S., India, 24 m., April 3, 1910.

Arnim, Lieutenant-Colonel H. C. L., I.M.S., Bo., 24 m., June 14, 1911.

Bedford, Lieutenant-Colonel C. H., I.M.S., 6 m., April 18, 1911.

Beit, Captain F. V. O., I.M.S., Burma, 24 m., November 24, 1909.
Brierly, Captain C. J., I.M.S., N.-W.F. Prov., 6 m., March 19, 1911.
Bryson, Major R., I.M.S., M., 24 m., October 8, 1910.
Burnett, Major S. H., I.M.S., Bo., 24 m., October 4, 1910.
Cadell, Lieutenant-Colonel J. M., I.M.S., U.P., 16 m., April 26, 1911.
Carter, Captain R. M., I.M.S., 5 m., October 27, 1910.
Chatterton, Major B. R., I.M.S., B., 7 m. 9 d., March 27, 1911.
Chaytor-White, Lieutenant-Colonel J., I.M.S., U.P., 18 m., March 26, 1910.
Clarkson, Lieutenant-Colonel F. C., I.M.S., B., Med. Dept., 24 m., March 1, 1910.
Clements, Captain J. E., I.M.S., 18 m., April 8, 1910.
Cook, Captain L., I.M.S., B., 24 m., September 7, 1910.
Corry, Captain M., I.M.S., Punj., 21 m. 22 d., February 16, 1909.
Crawford, Lieutenant-Colonel D. G., I.M.S., B., 24 m., April 2, 1910.
Deas, Captain L. J. M., I.M.S., India Foreign, 15 m. 23 d., October 1, 1910.
Dimmock, Lieutenant-Colonel H. P., I.M.S., Bo., 6 m. 28 d., October 15, 1910.
Drury, Lieutenant-Colonel F. J., I.M.S., Principal Med. Coll., Calcutta, 9 m., March 16, 1911.
Elliott, Major R. H., I.M.S., M., 6 m., May 8, 1911.
Fisher, Major J. I.M.S., D.S.O., Rajpootana, 18 m., May 26, 1909.
Forster, Major W. H. C., I.M.S., Punj., 6 m., April 1, 1911.
Foulkes, Major T. H., I.M.S., M. 12 m., May 1, 1911.
Franklin, Captain G. D., I.M.S., India Foreign, 12 m., November 24, 1910.
Gabbett, Major P. C., I.M.S., M., 24 m., August 27, 1910.
Gilbert, Captain L. E., I.M.S., Burma, 24 m., January 27, 1910.
Goldsmith, H. M., Captain J. F., I.S.M.D., Burma, 12 m. May 15, 1911.
Good, Captain J., I.M.S., Burma, 24 m., April 19, 1911.
Gourlay, Captain C. A., I.M.S., E.B. and A., 18 m., April 7, 1911.
Green, Major D. R., I.M.S., E.B. and A., 24 m., February 8, 1910.
Greig, Captain A. W., I.M.S., Burma Gaols, 24 m., May 3, 1910.
Greig, Major E. D. W., I.M.S., India Research, 8 m., April 1, 1911.
Hefferman, Assist. Surg. W. St. M., I.S.M.D., Burma, 19 m., April 9, 1910.
Hooton, Major A., I.M.S., Bo., 21 m., February 6, 1910.
Hore, Lieutenant-Colonel E. W., I.M.S., India Foreign, 6 m., June 8, 1811.
Houston, Captain W. M., I.M.S., 19 m., June 8, 1910.
Hudson, Lieutenant-Colonel C. T., I.M.S., Bo., 24 m., March 19, 1911.
Hudson, Lieutenant-Colonel E., I.M.S., U.P., 24 m., November 8, 1909.
Hunt, Major S., I.M.S., India Foreign, 19 m. 6 d., April 9, 1910.
Hunter, Major G. Y. C., I.M.S., B. Gaols, 18 m., March 30, 1911.
Hynes, Captain G., I.S.M.D., U.P., 18 m., April 16, 1910.
Illius, Captain H. W., I.M.S., U.P., 12 m., March 14, 1911.
Jameson, Lieutenant-Colonel J. B., I.M.S.
Jennings, Lieutenant-Colonel W. E., I.M.S., Bo., 8 m., January 28, 1910.
Kilkelly, Major P. P., I.M.S., Bo., 24 m., March 13, 1911.
L. Said uz-Kafar Khan, I.S.M.D., U.P.
Lamb, Major G., I.M.S., 29 m., May 27, 1209.
Lane, Lieutenant-Colonel W. B., I.M.S., C. P. Prisons.
Lane, Major C. A., I.M.S., B., 22 m. 2 d., December 28, 1909.
Lapsley, Captain W., I.M.S., U.P.
Leicester, Major J. C. H., I.M.S., B., 24 m., November 8, 1910.
Little, Captain J. W., I.M.S., N.-W.F. Prov., 17 m., May 10, 1910.
Lumsden, Lieutenant-Colonel P. J., I.M.S., Res. Surgeon, Hyderabad, 8 m.
McPherson, Captain J. I.M.S., Res. Surg., Turkish Arabia.
Macrae, Major J. L., I.M.S., India Foreign, 8 m., February 2, 1911.
Mactaggart, Lieutenant-Colonel, the Hon. C., I.M.S., Insp.-Gen. of Prisons, U.P., 20 m., March 1, 1911.
MacWatt, Lieutenant-Colonel R. C., I.M.S., India Foreign, 24 m., November 4, 1910.
Maddock, Captain E. C. G., I.M.S., Bo., 19 m. 12 d., from March 20, 1910.
Maddox, Major R. H., I.M.S., B., 10 m., January 14, 1911.
McCoy, Captain J. W., I.M.S., E. B. & A., 20 m., March 16, 1910.
Melhuish, Captain H. M. H., I.M.S., Punj., 18 m., May 16, 1911.
Meyer, Lieutenant-Colonel C. H. L., I.M.S., Bombay, 4 m. 15 d., June 5, 1911.
Milne, Major C., I.M.S., F.P., 17 m., April 19, 1910.
More, Major P. St. C., I.M.S., Punjab, 20 m., April 29, 1911.
Mulvany, Major J., I.M.S., B. Gaols, 20 m., March 11, 1910.
Murray, Major J. H., I.M.S., Port Blair, 24 m., July 30, 1910.
Nott, Lieutenant-Colonel A. H., 6 m., April 18, 1911.
Oxley, Captain J. C. S., I.M.S., C.P., 20 m. 2 d., October 29, 1910.
Pearson, Captain W. M., I.M.S., U.P., Med. Dept., 18 m., March 16, 1910.
Peck, Major E. S., I.M.S.
Penny, Major, I.M.S., Burma, I.M.S., Burma, 20 m., February 21, 1910.
Pisani, Lieutenant-Colonel L. I., I.M.S., 21 m., September 10, 1909.
Pratt, Lieutenant-Colonel J. J., I.M.S., U.P., 18 m., November 16, 1910.
Quicke, Lieutenant-Colonel W. H., I.M.S., Bo., 16 m. 7 d., December 18, 1909.
Rai, Captain D. G., I.M.S., M., 15 m., March 21, 1911.
Rait, Major J. W. F., I.M.S., B. 14 m., September 20, 1910.
Ritchie, Captain W. D., I.M.S.. E. B. & Assam, 24 m., December 26, 1909.
Rogers, Major L., I.M.S., B., Med. Dept., 9 m., March 3, 1911.
Southon, Captain C. E., I.M.S., 21 m., May 12, 1910.
Steen, Captain R., I.M.S., U.P., 12 m., October 13, 1910.
Stephen, Captain L. P., I.M.S., Bo., 16 m., November 4, 1910.
Stevens, Major C. R., I.M.S., B., Med. Dept.
Stokes, Captain T. G. N., I.M.S., C.P., 6 m., May 6, 1911.
Swan, Captain J. G. G., I.M.S., Punj., 24 m., November 9, 1909.
Tucker, Captain W. H., I.M.S., M., 19 m., April 10, 1910.
Turner, Major R. G., I.M.S., U.P.
Vaughan, Lieutenant-Colonel J. C. S., I.M.S., Bengal, 24 m., October 31, 1909.
Watson, Major T. E., I.M.S., 24 m., December 3, 1909.
Watts, Captain H., I.M.S., Punj., 13 m., September 22, 1910.
Wells, Captain N. S., I.M.S., U.P., 12 m., May 13, 1910.
Williams, Captain H. A., D.S.O., I.M.S., 24 m., February 18, 1911.
Williams, Captain T. S. B., I.M.S.
Williams, Major C. E., I.M.S., Burma, 15 m., May 19, 1910.

### List of Indian Military Oficers on Leave.

*Showing the Name, Regiment, or Department, and the Period for which the Leave was granted.*

Anderson, Captain D. N., I.M.S., to November 24, 1911.
Baker, Captain D. G. R. S., I.M.S., 1 year, from December 13, 1910.
Barnett, Lieutenant J. W., I.M.S.
Bensley, Lieutenant-Colonel C. N., I.M.S., 20 m., from March 12, 1910.
Benson, Surgeon-General R. H., C.B., I.M.S.
Blenkinsop, Major F. L., I.M.S., 19 m., from April 4, 1910.
Boalth, Captain W. H., I.M.S., 8 m., from May 13, 1911.
Bradfield, Captain E. W. C., I.M.S., 1 year, from March 1, 1911.
Brassey, Captain L. P., I.M.S., 16 m., from March 28, 1911.
Brierley, Captain W. E., I.M.S., 7½ m., from March 7, 1911.
Carter, Captain R. M., I.M.S., till July 26, 1912.
Croly, Captain R. G. G., I.M.S., 16 m., from August 23, 1910.
Cunningham, Captain J., I.M.S., 19 m., from May 23, 1910.
Daly, Lieutenant-Colonel J. T., I.M.S., 18 m., from April 19, 1910.
Earle, Major H. M., I.M.S.
Fawcett, Captain F. O'D., I.M.S., 12 m., from December 2, 1910.

Fitzgerald, Captain D., C.V., I.M.S., 1 year, from June 4, 1911.
Fleming, Major A. N., I.M.S., 18 m., from May 19, 1910.
Gilbert, Lieutenant-Colonel C. E. L., I.M.S., 14 m., from September 24, 1910.
Grainger, Colonel T., I.M.S.
Graves, Major D. H., I.M.S., 1 yr., from March 28, 1911.
Greany, Lieutenant-Colonel H., I.M.S.
Harris, Captain E. T., I.M.S., 8 m., from January 26, 1911.
Heron, Captain D., I.M.S., to June 9, 1912.
Holmes, Captain L. M., I.M.S., 12 m., from February 23, 1911.
Hynes, Captain G., I.S.M.D., 18 m., from April 16, 1910.
James, Captain J. F., I.M.S., 6 m., from May 3, 1911.
Kennedy, Captain R. S., I.M.S., 1 yr., from October 12, 1910.
Ker, Lieutenant-Colonel M. V., I.M.S., from May 18, 1911.
Leonard, Captain W. H., I.M.S., 1 yr., from February 21, 1911.
Lister, Captain A. E. J., I.M.S., 8 m., from March 9, 1911.
Lloyd, Captain R. A., I.M.S.
Maunsell, Capt ain E. C. C., I.M.S., 19 m., from February 23, 1910.
McGillivray, Captain W. S., I.M.S., 18 m., from March 21, 1910.
Melhuish, Captain H. M. H., I.M.S.
Millar, Captain G. M., I.M.S., 18 m., from June 1, 1910.
Moorhead, Major A, I.M.S., 1 yr., from November 28, 1910.
Munro, Captain E. B., I.M.S., 1 yr., from May 19, 1911.
Pierpoint, Captain H. W., I.M.S., 1 yr., from January 9, 1911.
Rai, Captain D. H., I.M.S., 12 m., from April 25, 1911.
Reinhold, Captain C. H., I.M.S., 1 yr., from November 15, 1910.
Reynolds, Captain L., I.M.S., 11 m., from December 12, 1910.
Roberts, Captain E. A., I.M.S., 15 m., from July 18, 1910.
Sadler, Lieutenant A. W. W., I.S.M.D.
Shaw, Captain C. C. C., I.M.S., 17 m., from April 3, 1910.
Shettle, Captain F. B., I.M.S., 8 m., from March 23, 1911.
Stevenson, Surgeon-General H. W., I.M.S.
St. Romaine, Captain E. A., I.S.M.D., 6 months, from May 7, 1911.
Swinton, Major F. E., I.M.S.
Thomas, Captain A. N., I.M.S., 8 m., from March 7, 1911.
Trafford, Captain W. L., I.M.S., 1 yr., from March 14, 1911.
Tresidder, Lieutenant A. G., I.M.S.
Wernwicke, Captain F. P., I.M.S., 8 m., from March 21, 1911.
Whitamore, Captain V. N., I.M.S., 1 yr., from May 5, 1911.
White, Lieutenant-Colonel W. W., I.M.S., 1 yr., from February 26, 1911.
Williams, Captain W. E. R., I.M.S., 1 yr., from March 15, 1911.
Willis, Colonel C. F., I.M.S., to November 8, 1911.
Wright, Captain W. D., I.M.S., 1 yr., from March 24, 1911.
Young, Captain G. J., I.M.S., 12 m., from February 10, 1911.

COLONIAL MEDICAL SERVICES.

*West African Medical Staff.*

*No deaths.*

*No Resignations.*

*Retirements.*—W. N. Alexander, L.R.C.P., L.R.C,S.Edin.. L.F.P.S.Glas., D.P.H.Ireland, Medical Officer, Sierra Leone, retires with a gratuity; D. T. H. Croly, L.R.C.P., L.R.C.S. Edin., L.F.P.S.(Glas.), Medical Officer, Gold Coast; P. J. Garland, C.M.G., L.R.C.S., L.R.C.P.(Ireland), Deputy Principal Medical Officer, Gold Coast, retires on pension; W. F. Roach, M.D., M.S.(Montreal), L.A.H.(Dublin), F.C.S., retires with a gratuity.

*No promotions.*

*New appointments.*

The following gentlemen have been selected for appointment to the staff: G. G. Butler, B.A.Cantab, M.R.C.S.Eng., L.R.C.P.Lond., Sierra Leone; A. Connal, M.B., Ch.B.Glas., T.D.M. and H.Cantab (formerly Assistant at the Medical Research Laboratory at Lagos), Gold Coast; A. J. N. Crichton, M.B., Ch.B.(St. Andrews), Northern Nigeria; M. B. Hay, M.R.C.S.Eng., L.R.C.P.Lond., D.P.H.Lond., Gold Coast; A. Ingram, M.D., C.M.Edin., M.R.C.S.Eng., L.R.C.P.Lond., T.D.M. L'pool (formerly Medical Officer, Baro Kano Railway, Gold Coast); A. F. Kennedy, M.B., B.Ch., B.A.O., R.U.I., Gambia; A. J. R. O'Brien, M.B., Ch.B.(Edin.), D.P.H., B.Hy(Durham), Gold Coast.

*Other Colonies and Protectorates.*

Dr. Attilio Critien, Senior Medical Officer of Health, Malta, has assumed the duties of Chief Government Medical Officer and Superintendent of Public Health in consequence of the leave of absence granted on account of ill-health to the Hon. Dr. G. Carnana Sercluna.

Dr. Lewis J. O'Brien, of the City of Nanaimo, British Columbia, has become a Medical Health Officer for that Province.

Dr. Edwin Wells, Medical Officer, St. Lucia, has been transferred to Grenada in a similar capacity.

Dr. W. S. Sheppard, Senior Medical Officer, Province Wellesley, Straits Settlements, has been transferred to Singapore in a similar capacity, and is succeeded in Province Wellesley by Dr. E. D. Whittle from Singapore.

Dr. G. R. H. Chell has been appointed Medical Officer in Charge of the Northern Frontier District of the East Africa Protectorate.

R. Bury, L.R.C.P., F.R.C.S.(Ireland), L.M.(Rotunda), has been selected for employment as a medical officer in Nyasaland.

E. B. Bate, M.B., B.Ch., B.A.O.Dublin, has been selected for appointment as Public Physician at Inagua, Bahama Islands.

R. Hamillon, M.D., B.Ch.Edin., has been selected for appointment as a Medical Officer in the East Africa Protectorate.

J. A. Mackintosh, M.D., (Rush Medical College, Chicago, U.S.A.), Public Physician at Inagua, has been appointed an Assistant Surgeon in Nassau, Bahama Islands.

J. C. A. Ridgway, M.D., B.Ch., B.A.O.Dublin, L.M.Ireland, has been selected for appointment as a Medical Officer in Uganda.

# Recent and Current Literature.

*A list of recent publications and articles bearing on tropical diseases is given below. To readers interested in any branch of tropical literature mentioned in these lists the Editors of the* JOURNAL OF TROPICAL MEDICINE AND HYGIENE *will be pleased, when possible, to send, on application, the medical journals in which the articles appear.*

## "Medical Record," July 29, 1911.

Gilman Thompson reports four cases of non-parasitic elephantiasis in the above number of the *Medical Record*. Such a condition may and does prevail, though comparatively rarely, in countries where filariasis does not exist. The pathology of the condition is obscure, and in Thompson's four cases there was no history of any disease, injury, or condition which might conceivably have given origin to the lymphangitis. Similar cases occur from time to time in London in people who have been born in that city and have never been out of it. Filariasis can then, of course, just as in Thompson's cases, be excluded. Thompson's article is illustrated with good photographs, and is worth looking at.

## "Bulletin of the Manila Medical Society," June, 1911.

*Myiasis.*—Brewer reports a case of *Myiasis narium* from Fort Huachuca, Arizona. The patient was admitted suffering from catarrh of his nose. A few days later he was put under an anæsthetic, and chloroform injected into the nostrils; this resulted in the killing of a large number of screw worms. Some time after similar symptoms returned, and after sniffing some salt water up his nose a small maggot was expelled. After this an anæsthetic was again given, and both nasal cavities were injected with a 50 per cent. solution of chloroform, which completely relieved the pain from which the patient had previously been suffering. During the following ten days seventeen dead "screw worms" were expelled. After this recovery was rapid. Creolin and permanganate of potash are also used for injecting up the nose in such cases. Brewer believes the best treatment is to anæsthetize the patient, and then to use a 50 per cent. solution of chloroform for injecting into the nostrils.

**"Journal of the Royal Army Medical Corps," No. 2, August, 1911, vol. xvii.**

Grattan and Wood, writing on paratyphoid fever in India, conclude that a considerable proportion, probably a third, of the cases returned in India as pyrexia of uncertain origin are in reality cases of paratyphoid fever due to infection by the *B. paratyphosus* A. What this means in extent of prevalence is apparent when it is considered that no less than 4,386 cases of pyrexia of uncertain origin occurred among British troops in India in 1909. The highest incidence was during the months of April and May. Under the same heading in 1910 the cases dropped to 2,733.

**"Report of the Department of Sanitation of the Isthmian Canal Commission," May, 1911.**

John L. Phillips, Acting Chief Sanitary Officer for the Isthmian Canal Commission, reports that during the month of May, 1911, the total number of deaths from all causes among employees was forty-four. Thirty-three of the number died of disease, eleven from violence. The principal diseases were as follows: Nephritis, acute and chronic, 5; lobar pneumonia, 6; malarial fever, 6; tuberculosis, 4; typhoid fever, 2. No cases of yellow fever, small-pox, or plague originated on or were brought to the Isthmus during the month.

**"New York Medical Journal," July 29, 1911.**

Rosenberger and Brinton report a case of infestation with *Necator americanus* in a native of Madras, India. The native in question had just arrived in the States, and at first it was thought he had an infection with the old-world hook-worm. Smith and Stiles, to whom the worms were sent, demonstrated the true nature of the parasite in question. The name *Americanus*, as applied to the American hook-worm, is a misnomer, because, as Leiper has pointed out, they are equally prevalent in Africa amongst natives who have never been out of Africa. Pigmies from the Congo forests have even yielded them. Their importation into America has evidently been from Africa, and it is no longer correct to talk of them as the new world ankylostome.

**"Journal of the Royal Army Medical Corps," August, 1911.**

*Eucalyptus Poisoning.*—Major Samman reports a case of eucalyptus poisoning which presented many points of interest. The patient, a soldier, drank three-quarters of an ounce of the oil of eucalyptus in order to cure a cold. He immediately became dizzy, but managed to get to bed. When found he appeared to be in a deep sleep, from which, however, he could not be roused. His temperature was normal, breathing normal, pupils slightly dilated, while his pulse was 60, full and steady. The state of coma persisted throughout the night, but at 8 o'clock next morning he awoke naturally, complaining only of a slight pain in the head. During all the time he had been asleep he had not passed water nor had a motion. He made a good recovery, and eventually went back to work apparently none the worse for his adventure.

**"Interstate Medical Journal," August 1911, vol. xviii., No. 8.**

Warfield reports a case of malignant (æstivo autumnal) malaria with an unusual anæmia. The count of the cells showed red blood corpuscles 1,520,000; white corpuscles 4,550, hæmoglobin 38 per cent. The blood was very pale, watery, and thin, but did not have the appearance sometimes seen in pernicious anæmia of a separation of plasma and red cells. At first a diagnosis of pernicious anæmia was made and the patient was given arsenic. Later during a febrile attack malarial parasites were found and the true nature of the case was thus determined.

**"Bulletin of Entomological Research," vol. ii., part ii., pp. 85-186, July, 1911.**

The number of the above bulletin for July, 1911, contains the following original articles: New African Hippoboscidæ; three New African Species of the genus *Chrysops* (Family *Tabanidæ*); Two New Species of Tabanus from the Anglo-Egyptian Sudan, by Ernest E. Austen. Some New West African Species of Anopheles, with Notes on Nomenclature, by F. W. Edwards. A Fish that Preys on Mosquito Larvæ in Southern Nigeria; Results obtained from a Monthly Examination of the Native Domestic Water-receptacles at Lagos, Southern Nigeria in 1910-11; The Photography of Diptera, by Dr. W. M. Graham. The Relation between Game and Tsetse Flies, by Major J. S. Hamilton. Anoplura and Mallophaga from African Hosts, by V. L. Kellog and J. H. Paine. Description of Haunts of *Glossina tachinoides* in Bornu Province, Northern Nigeria, by Dr. B. Moiser. Observations on African Scale Insects (*Coccidæ*) (No. 3); On a New genus of *Psyllidæ* from Nyasaland; On the Genital Armature of the Males of *G. medicorum*, Austen, and *G. tabaniformis*, Westwood, by Robert Newstead. Notes on the Habits of Blood-sucking Flies Observed in Dowa District, Nyasaland, by Dr. Meredith Sanderson.

## EXCHANGES.

American Journal of Surgery. Annali di Medicina Navale. Annal d' Igiene Sperimentale. Archiv für Schiffs u. Tropen-Hygiene. Archives de Médecine Navale. Archives de Parasitologie. Archives of Internal Medicine. Archives Russes de Pathologie, de Médec. Australasian Medical Gazette. Boletin de Medicina Naval. Boston Medical and Surgical Journal. Bristol Medico-Chirurgical Journal. British and Colonial Druggist. British Journal of Dermatology. British Medical Journal. Brooklyn Medical Journal. Bulletin Médical de l'Indo-Chine Française. Caducée. Clinical Journal. Clinique et de Bacteriologie. Gazetta Internazionale di Medicina, Chirurgia, Igiene. Giornale Medico del R. Esercito. Hong Kong Telegraph. Il Policlinico. Indian Medical Gazette. Indian Medical Record. Indian Public Health. Interstate Medical Journal. Jahresbericht. Janus. Journal of the Royal Army Medical Corps. Journal of Laryngology and Otology. Journal of the American Medical Association. Journal of Experimental Medicine. Journal of Tropical Veterinary Science. La Grèce Médicale. Lancet. Liverpool Medico-Chirurgical Journal. London and China Express. Medical Brief. Medical Missionary Journal. Medical Record. Medical Review. Merck's Archives. New York Medical Journal. New York Post-Graduate. Pacific Medical Journal. Philippine Journal of Science. Polyclinic. Revista de Medicina Tropical. Revista Medica de S. Paulo. Sei-i-Kwai Medical Journal. The Hospital. The Northumberland and Durham Medical Journal. Transactions of the American Microscopical Society. West India Committee Circular, West Africa. New York State Journal of Medicine.

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## Original Communications.

# REMARKS UPON THE ETIOLOGY AND PROPHYLAXIS OF MALTA FEVER IN SOUTH AFRICA.

By Alexander Garrow, M.D.Glas.

*Steytlerville, South Africa; formerly Resident Physician, Glasgow Royal Infirmary, &c.*

*(Part of this paper was contributed to the Public Health Section, South African Medical Congress, 1910.)*

At the outset I wish to say that what follows in this paper is nothing more than what the title says —that is to say, remarks. Towards the end of 1908 and during the first few months of 1909 there were abundant opportunities for making definite and precise observations on the above subjects, but various circumstances prevented me from making use of them. I have paid more attention to the clinical aspect of this disease, because that fitted in better with one's daily work.

In 1887 Colonel (now Sir David) Bruce, of the Royal Army Medical Corps, announced his discovery of the causative organism of Malta fever, and it has received the name of *Micrococcus melitensis*.

In 1906 the Mediterranean Fever Commission made the important discovery that the goat plays the most important part in the dissemination of the disease by discharging the micrococci in its milk and in its urine.

Through the kindness of Dr. J. A. Mitchell, the Secretary of this Section, I have had the opportunity of reading the first four parts of the Reports of the Commission.

The following are some of the results of, or conclusions drawn from, experiments made by the Mediterranean Fever Commission, and described in the first four parts of their Reports:—

(1) The micrococci can be isolated from the urine of Malta fever patients, but they have not been isolated from the fæces, the expired air, or the sweat;

(2) The micrococci are present in the peripheral blood of most cases examined, but in such small numbers as to make it very difficult for the disease to be carried by biting insects;

(3) The inhalation or ingestion of infected dust, and the swallowing of infected food will give rise to the disease;

(4) In a Maltese soil allowed to dry naturally the micrococci were found to have retained their vitality for forty-three days, and in a damp soil for seventy-two days, and on dry khaki cotton, khaki serge, and blankets, for eighty days;

(5) Exposure to the sun for a few hours kills the micrococci;

(6) No micrococci were found to have been washed through a Chamberland filter, or Berkefeld filter;

(7) Pasteurization at 68° C. for ten minutes destroys the micrococci present in infected goat's milk.

With regard to the conditions in Steytlerville district, the goat population of which, in 1907, was estimated as 266,343, I should like to make the following remarks. During the whole of 1908 and until March, 1909, the district of Steytlerville suffered from a severe drought. During that period disease was very prevalent amongst the goats, and there were many deaths. Farmers were almost unanimous in saying that the goats began to die before the scarcity of food and water was sufficient to be the only cause. I regret, now, that I did not get more blood specimens from these goats, so as to find out to what extent Malta fever was responsible for the disease and deaths amongst them. I sent only one specimen to the laboratory from Angora goats, and it reacted positively for Malta fever. But one examination is scarcely worth mentioning when we are dealing with a disease of which thousands of animals died. As I have already mentioned, several circumstances prevented me from taking up the work which an inquiry of this kind would have entailed.

During drought, fewer goat ewes conceive than during good seasons, and abortions are the rule amongst those that do. So that a farmer who gets six hundred or more kids in a good season may get less than a score at a kidding season during a severe drought. A ewe dries up almost immediately after an abortion. This extreme scarcity of kids, and consequent scarcity of goat's milk, was the general rule here in 1908, and yet during that time and until the drought broke in 1909 Malta fever became increasingly prevalent. That led me to think that during that period goat's milk was not the only, and, perhaps, even not the main, etiological factor in the spread of the disease, although, unfortunately, I did not make definite notes as to whether each case had or had not used goat's milk. I always made the inquiry, and the usual reply was: "We have not got enough milk for the coffee even." However, I did not go definitely and deeply enough into the question so as to make certain that each case who denied the use of goat's milk actually was absolutely without it. A very usual occurrence was that when I would inform a patient that he had Malta fever, he would say: "But how is it possible, when we have not had milk on the farm for months?"

Amongst other factors which I think must have played a very considerable part in the spread of the disease must be mentioned the swallowing of urine-affected kraal dust, and the fouling of the hands and inoculation through abrasions with infected urine in handling the urine-soaked fleeces of sick goats. Even if the disease which ravaged the goats at that time was some other than Malta fever, it is almost certain that many of them had the latter disease in addition to any other which may have been the immediate cause of death, and were discharging the *M. melitensis* in their urine.

During a drought there is much handling of sick goats, and the farm people spend much more of their time in the goat kraals than during good seasons; therefore the inhalation and ingestion of infected dust was very continuous, and for a prolonged period, which were the conditions which the Malta Fever Commission found necessary experimentally for the production of infection by these means.

Again, the aggregate number of goats slaughtered in a stock district for food purposes in the course of a year must be very great. On one extensive property in this district, for instance, about five hundred animals are slaughtered annually for food purposes to supply the households of the three owners and of about 12 herds. Boer goats are most commonly used for that purpose. Malta fever is an easily inoculable disease, so that inoculation of the farmer who kills and dresses the animal, if the former stabs or scratches himself with knife, saw, or bone spicule, or if he has, as is often the case, open sores or scratches on his hands or arms, and if the latter has micrococci in its blood, must be considered as one of the factors in the spread of the disease.

Milk from a healthy goat may become infected by the udder becoming fouled with infected urine in the kraal.

Children may become infected through the milk of infected mothers. I have sent to the Public Health Laboratory samples of human milk which gave positive Widal reaction.

The most dangerous part of the goat kraal is that which is protected from the germ-destroying sun by a galvanized roofing, the part known as the shed, or *schuur*.

The following means to check the spread of the disease would naturally suggest themselves:—

(*a*) Drinking-water should be boiled;

(*b*) Milk should be strained and thoroughly boiled, and also that used for coffee and tea;

(*c*) Goat kraals should be built as far away from the houses as possible, and on the prevailing leewards side of them. Sheds should be fenced off from the kraals, and only used when the weather conditions demand it. Goats which are visibly sick should be isolated from the apparently healthy.

(*d*) In slaughtering and dressing goats, care should be taken not to wound the hands or arms with the knife, saw, or rough ends of bone, and the hands and arms should be well cleansed afterwards. In making *post-mortem* examinations on dead goats, which is very frequently done, even greater care should be exercised;

(*e*) After attending to sick goats, the hands should be thoroughly cleansed;

(*f*) Infected mothers should not suckle their children;

(*g*) Those who nurse cases of Malta fever should be instructed to handle carefully and disinfect the fæces, and more particularly the urine.

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## A NOTE ON THE TRANSMISSION OF LEPROSY.

By E. C. Long, M.R.C.S., L.R.C.P.

*Principal Medical Officer, Basutoland.*

The means by which leprosy bacillus is introduced into the human body have not yet been definitely established.

Commensal feeding, direct inoculation or contagion have been generally accepted as being the most likely methods of introduction, but no proof of any of these methods has yet been adduced, and I believe the leprosy bacillus has hitherto not been found outside the human body.

The fact that leprosy is most common among people of unclean personal habits and living in unhygienic surroundings points to some co-existing source of contagion.

The possibility of the bacillus being carried by vermin occurred to the writer. With a view to testing this hypothesis, bed bugs obtained from huts which had never been inhabited by lepers were caused to bite lepers in the neighbourhood of leprous nodules on the face. The bugs were then killed and the alimentary tract and its contents examined. In every bug that bit freely a bacillus was found, which in shape, size, and staining reactions is similar to the *Bacillus lepræ*.

Control bugs from the same hut gave in every instance a negative result.

The experiments are still in progress, and it is intended as soon as circumstances permit to solve the following questions:—

(1) How long the bacilli remain in the bug's body;

(2) If bugs which over a period of weeks have fed on the blood from leprous nodules present any evidence of growth of bacilli in their tissues;

(3) What organs of the bug contain bacilli;

(4) Whether any other vermin, *e.g.*, fleas and lice, contain bacilli.

These experiments are only regarded as preliminary to a thorough investigation of the subject, but the question is so important that I have ventured to record my results in the hope that other observers may be induced to experiment on the same lines. I think it will be found that lepers may be inoculated by infected bugs, and this point can be elicited by causing infected bugs to bite lepers on parts of the skin on which there are no leprous lesions.

If my hypothesis is correct a great many facts regarding the spread of leprosy which have hitherto been inexplicable would be made clear. Inquiries into the past history of certain lepers go to show that they could only have become infected with leprosy through some intermediate host.

The fact that plague is carried by fleas warrants, at any rate, the inference that leprosy may possibly be carried by bugs. Further, the fact that only a percentage of human beings are attacked by the bed bug, or, for the matter of that, by the flea, would serve to explain why it is that only some

of those people who live in close association with lepers become lepers also.

All lepers that I have questioned admit that bugs bite them freely, and it is not unreasonable to assume that such a voracious feeder as the common bug must, in the course of his nightly meal, ingest a considerable number of leprosy bacilli if his bites are in the neighbourhood of leprous nodules which are often swarming with the *B. lepræ*. If such infected bugs were thereafter to bite a non-leper there would be a good chance of the bacillus being introduced into his system.

The following history of a recent case of leprosy is only explicable by assuming some such method of infection as suggested above.

A native, X, residing in a village about three miles from Maseru, presented himself as an out-patient about three months ago with some well-marked "tubercular" leprous patches on the face. They had appeared about six weeks previously. There are no lepers in his village, and none of his relatives are lepers. Inquiries into how he had spent his time and where he had been during the preceding year, elicited the fact that he had during that period visited on three or four occasions a village about fifty miles away where there was one leper, who was, however, driven from the village during the period in question. X had been in the leper's hut, but had never partaken of food there. After the leper had been driven away, X spent one night in the hut and was severely bitten by bugs there.

The closest questioning failed to elicit any further evidence of contact with lepers or their dwellings, and one is almost forced to the conclusion that X was inoculated by leprosy-infected bugs or other parasites on the one night he spent in the infected hut.

PARKE, DAVIS AND CO., Beak Street, Regent Street, London, W., in their "Therapeutic Notes" for May, 1911, draw attention to (1) Taka-Diastase as a useful preparation in alleviating diabetic troubles; (2) the therapeutic value of the Nuclein compounds; of these, Mercurol in solution is valuable as an antiseptic lotion and injection; Cuprol as an astringent; Nargol especially useful in gonorrhœa; and Ferrinol as an efficient and agreeable form in which to administer iron. As a local anæsthetic, especially ano-rectal surgery, quinine with urea hydrochloride is recommended in any case in which the skin is not involved in the operation.

An obstetric handbag, completely equipped with all obstetric wants, should find favour with practitioners. *Pituitrin*, as a cardio-vascular stimulant, has gained a considerable reputation, and with increased experience the value of this preparation will be enhanced.


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## BRITISH MEDICAL ASSOCIATION.

### SECTION OF TROPICAL MEDICINE, Wednesday, July 26, 1911.

Sir FRANCIS LOVELL, C.M.G., in the Chair.

IN opening the Section of Tropical Medicine and Hygiene, the President, Sir Francis Lovell, Dean of the London School of Tropical Medicine, referred to the sad loss the Liverpool School of Tropical Medicine had sustained through the death of the late Sir Rubert Boyce, Dean of the School, and proposed conveying to the School an expression of sympathy and condolence in its loss on behalf of this Section in Tropical Medicine and also on that of the London School of Tropical Medicine, and referred to the happy and cordial relations that have always existed between the two Schools of Tropical Medicine. He said he further wished to convey to the Liverpool School an expression of congratulation on the high honour recently conferred upon Sir Ronald Ross, and hoped he might live long to enjoy it. He also referred to the opportunities he had recently had when visiting the West Indies and British Honduras of seeing the advantages the Colonies had already derived from following the advice given them by Sir Rubert Boyce in regard to the methods for the abolition of malarial fever and other Tropical diseases.

### THE SPREAD OF PLAGUE.

By C. T. MARTIN, M.B., D.Sc., F.R.S.

*Director of the Lister Institute of Preventive Medicine, Member of the Advisory Committee for the Investigation of Plague in India.*

Dating his remarks from the appearance of plague in Hong Kong in 1894, Dr. Martin referred to the pandemic of the disease at present, and to the heavy mortality it has occasioned more especially in India, where, during the past fifteen years, it has occasioned upwards of 7,000,000 deaths.

*The Infectivity of Plague.*

Bubonic plague is for practical purposes not infective unless it develops a secondary pneumonia, and the frequency of single cases of a bubonic nature in several countries would seem to corroborate this belief. Pneumonic plague, however, is eminently infectious and gives rise to further pneumonic cases, but all persons infected through the lungs may not exhibit pneumonic symptoms in a marked degree, but instead a primary septicæmic condition. The most extensive epidemic of pneumonic plague has been the recent 1910-11 outbreak in Manchuria, where the disease seems to have been almost exclusively pneumonic from the outset.

*Origin and Spread of Pneumonic Plague.*

Plague bacilli entering the lungs may set up a plague-pneumonia, or bacilli gaining access by any other channel may cause a general infection and occasion a secondary pneumonia. When bubonic plague prevails, pneumonia is not uncommon, and a case of bubonic plague is therefore a potential source of a pneumonic outbreak; both clinically and experimentally it is known that the sputum in plague pneumonia is infective by the direct conveyance of the bacilli from man to man. Dr. Martin therefore considers that pneumonic plague is easily to be controlled by early isolation of patients and contacts.

*The Spread of Bubonic Plague.*

Bubonic plague being practically non-infective, the problem of its spread is more difficult to solve.

*Rats and the Spread of Plague.*

Mortality amongst rats has long been associated with the presence of plague amongst human beings, and the brunt of evidence goes to show: (1) that plague in rats precedes the first case in man; (2) that the areas of infection of rats and man seem coextensive; (3) that the disease is conveyed from rat to man. Rat plague rises and falls a few weeks prior to the human epidemic, but this does not prove that man derives the disease from the rat, as both might be infected from the same source, and the rat being more susceptible shows the existence of the disease in epidemic form first; it would seem proven, however, that although rat plague exists in epidemic form without man being the subject of the disease, that the converse holds good.

*How is Infection Conveyed from Rat to Man?*

By the infection of food by the excreta of plague-infected rats, or by some blood-sucking insect carrying infection from rat to man, are the two probable modes of transmission of the disease. That direct contact with the urine and fæces of plague-infected animals is an important means of communicating plague to other animals or to man is against the evidence at present forthcoming.

*The Vitality of Plague Bacilli.*

(*a*) *On the Soil.*—The chances of the survival of the plague bacillus if deposited upon soil and floors under natural conditions is not great, for the organism is by no means hardy when exposed to the influences of drying and sunlight and to the presence of hardier saprophytes, but it will survive for months in moist earth if this has been previously sterilized. The plague bacillus has never been recovered from the earth around infected dwellings, nor from the floors of huts; and an experimental infection of the earth or a cow-dung floor, even when grossly contaminated, retains its infectivity for two days at the utmost.

(*b*) *On Foodstuffs.*—Stored grain, owing to its being rat-contaminated, was at one time under suspicion as a means of conveying plague to man. All evidence is against this theory of infection, and the fact that grain is cooked before being eaten is sufficient to set aside the danger assigned to the infection of grain, even when plague-stricken rats pervade it in store.

*Alimentary Infection.*

Feeding experiments with plague-infected material have been tried and with varying results, some observers finding infection apparently most readily, others, again, obtaining negative results. Simpson's experiments in Hong Kong were positive to calves, pigs, hens, turkeys, geese, ducks, and pigeons; but Simond got negative results in experimenting with rats in whatever way plague bacteria were given, whether by emulsion, by virulent agar cultures, or by giving rats the organs and dead bodies of animals dead of plague or the sputum of cases of pneumonic plague. Other observers find positive results at one time and negative another. Animals, moreover, given large quantities of plague bacilli by the mouth without becoming in any way ill, died when the bacilli were administered hypodermically.

The Commission for the Investigation of Plague in India (*Journal of Hygiene*, 1907, vol. vii., p. 373) devoted particular attention to this question, with the following result:—

It was found possible to infect rats with plague by feeding them with grossly contaminated material of a soft nature, 21.4 per cent. of wild Bombay rats being susceptible to this method of infection. In a series of similar experiments made with *Mus rattus* in the Punjab 67.8 per cent. of the rats were susceptible, but in this series a much larger dose of infected material was given. Further, a large number of wild Bombay rats were infected by feeding them on the carcases of their plague-infected comrades. No difference as regards the *post-mortem* appearances or the distribution of the primary bubo was found between rats infected in this latter way and rats infected by feeding on soft contaminated material. But, while the general pathological lesions found in all rats infected by feeding were in the main the same as those found in rats naturally infected, there were observed two most important differences: First, in naturally infected rats, while the primary bubo was as a rule in the neck (74 per cent.), the axillary and inguinal glands being also often affected (25 per cent.), in not one single instance, out of 6,000 *post-mortem* examinations, was a bubo found in connection with the mesenteric

glands in the abdomen. On the other hand, in the rats infected by feeding, the neck glands were involved in only 29 per cent. of the cases, the inguinal and axillary glands were practically never affected, while the mesenteric glands were the site of the primary bubo in no less than 72 per cent. of the infected animals. Secondly, in the case of naturally infected rats the stomach and intestines showed, as a rule, no marked pathological change, while in the case of rats infected by feeding, well-marked lesions were found in the intestines. It would appear justifiable to conclude, then, that in Nature infection of rats by feeding rarely or never takes place, and that rats do not become infected by eating the carcases of their comrades. At least this method of infection can play no part in the epizootic spread of plague.

It would seem, therefore, that animals susceptible to plague by inoculation may be infected by feeding, but that compared with introduction under the skin the dose must be immense. There is, moreover, no epidemiological evidence other than that alimentary infection is uncommon.

*The Transmission of Plague by Fleas.*

The care, the ingenuity, and the patience displayed in the attempts to arrive at a true knowledge of the transmission of plague by fleas is without parallel in epidemiological records. By some observers positive results were obtained, by others, equally capable, negative conclusions were arrived at, but the consensus of opinions arrived at seemed to be that rats did not contract plague from one another by mere contact in the absence of fleas. Liston, in 1904, pointed out that the common flea infesting rats in India is not the *Ceratophyllus fasciatus* or the *Typhlopsylla musculi* as in Europe, but their place is taken by *Pulex cheopis*. The same observer also found that the plague bacillus multiplied in the stomach of *P. cheopis*, and that this flea takes readily to another host (the guinea-pig) when man is not available.

When the Commission for the Investigation of Plague in India was appointed in 1905, a prominent item in the programme drawn up by the Advisory Committee was the investigation of the part, if any, played by fleas in the spread of plague from rat to rat and rat to man.

After several failures a command of the conditions necessary was attained, and it soon became a simple matter to transmit plague from animal to animal by means of rat-fleas.

In the first series of successful experiments a glass case containing two wire cages side by side, each standing in a tin tray which collected the urine, was used. Both trays were filled with sand, in order to provide dryness and shelter for the fleas. Each cage was furnished with a lid through which the rats were introduced and food and water given to them. The whole apparatus was covered in with fine muslin to prevent the escape of the fleas. From this description it is seen that a rat placed in one of these wire cages could not come in contact with a rat in the other cage or with its urine and fæces.

The method of experiment was as follows: A plague-infected rat and a number of rat-fleas were placed in one of the wire cages. After the rat died, a fresh healthy rat was put into the other cage, the corpse of the infected rat being left in for twenty-four hours longer.

Sixty-six experiments with English white rats and with Bombay wild rats were done in this way, with the result that thirty healthy rats contracted plague; that is to say, there were 45 per cent. of successful transmissions. In all cases a fairly abundant supply of fleas was present; these could pass freely between the cages and, except for the air, formed the only apparent means of transmission of the bacilli from rat to rat.

In order to exclude aerial infection, a second series of experiments was carried out, in which fleas were taken from a rat which had died of plague and were placed on a fresh rat in a clean flea-proof cage of similar construction to that already described, but containing only one wire cage. Twenty-one (55 per cent.) successful transmissions out of thirty-eight experiments were obtained in this way, both English white rats and Bombay wild rats being again used. The possibility of the rat-flea carrying plague from one rat to another was therefore demonstrated directly.

*Without Fleas no Plague.*

Experiments in specially constructed brick animal houses, from which fleas were excluded, showed that in these houses plague-infected animals (rats or guinea-pigs) could be kept in close contact with healthy animals, running about together, eating out of the same dishes, and yet no infection of the healthy rats or guinea-pigs result. Even the carcases of plague-infected animals were not removed from the houses for some time after death, and in some instances the rats ate the carcases, yet without becoming plague-infected. In contrast with those experiments where fleas were excluded, we have those where fleas were present, and an epizootic occurred varying in extent and rate with the number of fleas present.

An important fact established by the Indian Commission was that the animal houses referred to above were proved to be infective three weeks after the last animal had died of plague. This period (three weeks) corresponds with the maximum time plague bacilli may be found to persist in fleas.

*The Bacilli in the Body of the Rat-flea.*

That in the stomach of the rat-flea the plague bacillus multiplies has been proved by careful experiments and observations. The bacilli can be recovered from the rectal contents of the flea, and have been shown to be virulent; but in no other part of the flea, except the alimentary canal, have the bacilli been seen.

*How the Flea Infects Healthy Animals.*

Possible means of transmission are: The animal eating the infected fleas; the mechanical conveyance by the pricker; the injection of bacilli along with the saliva, as the result of an infection of the salivary gland; the regurgitation of stomach contents or

blood about the mouth, and conveyed by the pricker. All these are unlikely modes of conveying the disease; the more probable, however, is the deposition of the infected fæces on the skin, the bacilli being subsequently rubbed in by scratching.

*Fleas as the Agents of Transmission from Rat to Man.*

That different animals harbour specific parasites may be regarded as generally true, but the specificity is not clearly defined, and fleas of one animal may frequently, under compulsion perhaps, be found on other animals. On rats, for instance, although the *P. cheopis* is the characteristic flea in India and in many other warm countries, and the *C. fasciatus* in colder climates, yet the fleas of the mouse, fowl, cat, or field-vole have been not infrequently gathered from the fur of the rat. Experiments with *C. fasciatus*, in which, after starvation, the fleas were allowed to bite man, gave a mean value of 59.6 per cent.

The ability of flea transmission to interpret the epidemiological facts and conclusions regarding bubonic plague would seem proved. Further, it would also seem true that infection may be conveyed to a distance upon the person, clothing or effects of an individual, even when the said individual does not himself contract the disease. From an epidemiological point of view this is a most important finding, and there is a multiplicity of evidence in support of the statement.

An experimental test of the adequacy of this method of transporting infection was carried out by the Indian Commissioners. Bundles of clothing from native houses in which plague had occurred were placed with guinea-pigs in a flea-proof cage, and although but few fleas were left in the clothing, there were sufficient to infect and kill the guinea-pigs.

*The Season-Prevalence of Bubonic Plague.*

In places where plague is endemic, the epizootic and epidemic appear, intensify, and disappear about the same time. Near the Equator the outbreaks recur earlier in the year than further north. Attempts have been made to associate the seasonal periodicity of plague-recurrence with the seasonal breeding of rats, but not very successfully. The coincidence of the epidemic season with the period of greatest flea-prevalence would seem to have been proved in the few observations that have been made, the height of the epidemic corresponding fairly closely with the season of maximal flea-prevalence.

*Effect of Temperature.*

The rat-flea hypothesis affords an interpretation of the fact that epidemics decline when the mean daily temperature passes 85° F. This statement would seem to have answered in explaining the prevalence of the plague in Bombay in the winter months, but it was not until the Commission for Investigation of Plague in India found that in Bombay the proportion of successful experiments on flea-transmission was greatest during the winter months that any light was thrown upon this matter. An analysis of the results gave 67 per cent. successful transmissions when the temperature was 73° to 78° F., against 14 per cent. successes when the temperature reached 82° to 85° F. The claims advanced that flea-transmission is the predominating mechanism of the spread of plague from rat to man may be summarized as follows:—

(1) Experimental evidence that plague is easily transmitted from animal to animal by rat-fleas.

(2) That in presence of fleas the epizootic, if started, varies as regards severity and rate of progress with the number of fleas present and the season of the year, whereas all attempts to induce epizootics in the absence of fleas have failed.

(3) That under natural conditions (experiments in plague houses, &c.) an animal can be protected from infection by any simple procedure which will exclude the visits of fleas.

(4) The only discovered infection in plague houses resides in plague-infected fleas.

(5) Rat-fleas (*P. cheopis* and *C. fasciatus*) readily bite man.

The conclusions drawn from animal experiments when applied to the problem of the spread of plague amongst human beings afford a reasonable interpretation of every cardinal epidemiological fact.

Professor J. W. R. SIMPSON, C.M.G., F.R.C.P., remarked that Dr. Martin had drawn particular attention to the fact that the infestation of rats with fleas varied according to the season; that epizootics of rat plague could be produced and maintained by putting infected fleas among healthy rats; and that the height of the rat epizootic corresponded with the greatest prevalence of fleas. The influence of infected food can, however, not be excluded, for although only 25 per cent. of the Bombay rats were infected by feeding, yet 67 per cent. of the Punjab rats were in this way infected. It was doubtful whether there was sufficient evidence to justify the conclusion come to by the Indian Plague Commission that, taking the flea as the principal agent in causing plague epizootics amongst rats, the same reasoning could be applied to human plague epidemics, viz., that the rat-flea is the cause of the majority of cases in a human epidemic. The present-day tendency is to look for insect carriers for most of our diseases, and although insects have been shown to play a part, as in typhoid, they have never been shown to be the only agents. Insect carriers may be a necessity as carriers where protozoal organisms are the cause of the disease, but this cannot be said of bacillary ailments.

Fleas were not needed for the infection of rats when a plague patient only was brought into a healthy locality, for it would seem to be a matter of infection from man to the rat. Plague epidemics do disappear without reference to a decline in the number of fleas, as in the case of the recent pneumonic plague outbreak in Manchuria. Professor Simpson hoped more would be done to combat plague; investigation was all very well, but unless some practical good was to result, the subject would tend to become one of mere academic interest.

A. T. CHALMERS, M.D. (Ceylon Medical College),

drew attention to the fact that in Ceylon, although plague was rife on the adjacent shores of India, and although the harbour of Colombo was a highway of commerce where ships called from plague-infected ports in India and China, the disease had not developed. Was it climate or temperature, or some other reason? None of the explanations for the prevalence of plague in certain parts seemed to elucidate the immunity Ceylon seemed to enjoy.

ANDREW BALFOUR, M.B. (Wellcome Research Laboratories, Khartum, Sudan): In the Sudan plague had not appeared, although it prevailed in Lower Egypt and along the Arabian littoral. *Hæmopsylla cheopis* occurs in the Sudan, and yet with plague on its borders, with pilgrims returning from the Hedjaz, suggesting the importation of mild cases of plague or infected rats or fleas, and what would seem suitable ground for development, plague, as far as can be ascertained, had never appeared in the Khartum district or anywhere in the Egyptian Sudan. Is it the high daily maximum temperature, which rarely falls below 85° F., that is the cause of the immunity?

It is, however, only fair to state that at Assuan plague is of the pneumonic type and the daily mean of temperature, in the summer months at least, is about as high as that obtained in northern Sudan. Iodoform is stated to be an excellent repellant of fleas.

M. GREENWOOD, Esq., jun. (Statistician to the Lister Institute): From an inquiry into the conditions of plague in Indian villages the following points would seem to be established:—

(1) Plague in these villages is generally introduced and re-introduced from without; it is not endemic and does not result from the re-kindling of embers left by a previous epidemic. In large centres of plague in India, that is, in the big cities, returns of plague cases are continuous through the year, although, when the epidemic is in abeyance, the number may be few. In villages, however, the disease completely disappears, and the question of re-infection is an interesting one. The facts seem to show that epidemics recurring in villages are due to the importation of infective material along the lines of customary human intercourse from endemic centres. The existence of an epidemic in a village during one season was no reason for assuming that this would recur in the following year. The numbers of outbreaks in a village seem to be quite erratic, at times frequently recurring and at other times disappearing for a year or two; this would seem to be best explained by recurring infection from an endemic centre.

(2) The distribution tends to follow the principal lines of human intercourse, such as railways.

(3) The severity of an epidemic depends upon local circumstances, the size of the village, and the date of the first infection.

(4) It is well-nigh if not wholly impossible to trace a direct relationship between intra-seasonal variations in meteorological factors and the severity of plague.

The result seems to coincide with the belief that the epidemic depends upon an epizootic, the intermediate carrier being a blood-sucking parasite. The Black Death of 1348-49 seems to have been of the pneumonic type for the most part, but buboes prevailed as well. There seems but slight evidence of an epizootic amongst rats during this outbreak.

G. FORD PETRIE, M.D. (Lister Institute), discussed the relation of animal plague to epidemics of pneumonic plague, from his experience in Manchuria.

Professor F. M. SANDWITH, M.D., F.R.C.P. (London): In Egypt bubonic plague prevails in Lower Egypt: pneumonic plague in the southern part of Upper Egypt; whilst in the Sudan plague has never been known. The original cases of plague in Egypt occurred at Alexandria among Greek dock labourers, who handled and unpacked bales of cargo from infected ports, some of these bales containing dead rats.

Heat above 85° F. is held to be inimical not to the plague bacillus, but to the flea; and the question is, Why does the flea dislike summer heat? It was in Alexandria that Dr. Gotschlick enunciated the idea that the breeding season of rats and the appearance of plague went hand in hand, but recent evidence is against this, and it is the bionomics of the flea and not of the rat that is now so ardently considered in dealing with the question of plague outbreaks.

H. G. STANNUS, M.B. (Nyasaland): The explanation of the difference of opinions concerning whether the seasonal recurrence of plague is due to prevalence and breeding time of rat-fleas or to the breeding of rats may be that the two coincide. In the rats' nests, as in the nests of other animals, it is possible that fleas congregate and thrive in the young rats' bodies, and the warmth of the nest favours their breeding. The appearance of the young rats and a fresh swarm of fleas would therefore coincide to a certain degree, and the question is, Which phenomenon is most closely associated with the appearance of plague?

Dr. LOUIS SAMBON, M.D. (London), said that the association of the rat with plague was historic, and all evidence in modern days tended in the same direction. Strabo mentions rats as the carriers of pestilence in the time of the Romans. It has been proved that the flea can remain without food for a long time, so that the possibility of its continuance from season to season is quite a feasible assumption. It is unfortunate that no epidemiological work is being done in regard to plague at the present time.

JAMES CANTLIE, M.B., F.R.C.S. (London): It is a fact that in large centres recurrences of plague take place year after year, almost to a day at the same period of the year as the initial outbreak. The appearance of the disease seems independent of climate or of latitude. In Hong Kong the initial epidemic in 1894 declared itself during the third week of April and every succeeding year, since recurrences take place at the same time. In Bombay the initial outbreak appeared in September, 1896, and ever since the annual recurrence begins then. Now Bombay and Hong Kong are almost in the same latitude. Their type of climate is very alike, and yet the maximum of prevalence in one case occurs at the height of the hot season, whereas in the other (Bombay) it is at the coldest time of the year. There

seems some explanation wanting to a better understanding of the curious discrepancy as regards seasonal prevalence.

It would also seem to be necessary to extend the scope of investigation beyond the rat, for most of the evidence goes to show that plague is not a disease of the rat, but as foreign to this rodent as it is to man. In that case the endemic source has to be sought for. The marmot or tarbagan (*Arctomys bobac*) has long been known to be chronically afflicted with plague, and the hunters and their families, who pursue the animal for its hide and for its flesh, are subject to plague. Again, in America the ground squirrel harbours plague, and the infection of this rodent is widespread. Pestis minor he had long held to be a forerunner of plague, but because it was not a fatal malady attention in recent years had been diverted from it. In Egypt in the first part of the last century pestis minor was held to be an *aura pestilentia*; in Baghdad in 1867 buboes prevailed before the epidemic developed, and in Mesopotamia in 1873-77, and again on the Volga in 1877, the same story is told. In the Straits Settlements, in the French possessions in Indo-China, and in Southern China, especially amongst sailors, "climatic buboes," so-called, were prevalent during 1892-93-94. His belief was that the plague bacillus undergoes in man a gradual increase in virility, passing from the non-fatal form of pestis minor to bubonic plague, and hence to the most virulent form met with in pneumonic plague.

## YELLOW FEVER.

Discussion held on Thursday, July 27, 1911,

BY J. W. W. STEPHENS, M.D.

*Lecturer on Tropical Diseases, University of Liverpool.*

There seems no doubt that yellow fever has occurred on the West Coast of Africa, and the question of its endemicity or introduction from without, from Central or South America, is the point at issue. Two factors are necessary: the presence of the Stegomyia mosquito and a virus. That the *Stegomyia fasciata* does exist on the West Coast is beyond doubt, and it is only the question of its numbers that requires elucidation. Too much attention must not be attached to numbers of insects in the prevalence of a disease, for malaria can and does exist to the extent of even 95 per cent. of the population of the village of Ennur, in Madras, although the carrier, *Myzomyia culicifacies*, is relatively scanty. It may well be asked, How is it that outbreaks of yellow fever are so limited in West Africa? Is it that the African native is naturally immune, or is the explanation to be found in the fact that he has acquired immunity? The African native is not naturally immune; we have at least fifteen outbreaks of yellow fever recorded in the Sudan, and during the American war in Cuba the negro troops suffered equally with the Americans. On the other hand, have the West Coast natives acquired immunity owing to their having passed through the disease in their youth? Is yellow fever endemic on the Coast? Sir Rubert Boyce held the opinion that yellow fever is endemic on the West Coast, and that the native is the reservoir, suffering from mild attacks in his youth and thus becoming immune. Dr. Stephens held the view that yellow fever is endemic in West Africa and that it is practically impossible to suppose that every outbreak has been due to a fresh introduction. Endemicity is a relative term—one autochthonous case in a century serves to constitute endemicity; and to state that a disease is endemic in any country does not imply that it is devastating the land, as many would appear to think, necessitating quarantine against its ports and so forth. The answer to the question of why it does not spread would seem to be obvious, namely, early infection and subsequent immunity; this is no new belief, for Pym, in 1848, believed yellow fever to be a disease of the interior of Africa, where it prevailed in a mild form. The statement had been made by Sir Rubert Boyce that bilious remittent fever was frequently confused with yellow fever. Again, Burton held the view that bilious remittent fever conferred an immunity against yellow fever, and more recently it was stated on good authority that since yellow fever in the West Indies subsided, bilious remittent fever has declined in like proportion. The difficulty of diagnosing yellow fever confronts us: there is no objective sign as in malaria, yet it would seem possible that many cases of so-called bilious remittent fever are really yellow fever. A disease freshly imported in any country is apt to declare itself in epidemic form, whereas epidemics in places where the disease is endemic are more rare. A good illustration of this can be instanced in the case of sleeping sickness in Uganda and the West Coast. On the Coast sleeping sickness is endemic, yet it is not seen as a raging scourge; in Uganda, on the other hand, the importation of the disease swept off two-thirds of the population. This phenomenon is all the more curious, for there is no such thing as acquired immunity against sleeping sickness on the Coast.

W. T. PROUT, C.M.G., M.B., C.M. (Liverpool): The presence of yellow fever on the West Coast appeared to turn upon the meaning of the term "endemicity." If the appearance of yellow fever in these regions from time to time meant endemicity, then he had no doubt the disease was endemic there. If, however, it implied, as Sir Rubert Boyce suggested, that it was constantly present in every locality among the natives in a mild and unrecognized form, it was difficult to accept the theory. If endemicity is widespread it is difficult to understand how freshly imported Europeans did not contract the disease. Dr. Prout's belief is that the disease spreads from place to place, assumes epidemic form and then dies out. An attempt to draw an analogy between malaria and yellow fever was not an apt one, for malaria is essentially a chronic ailment, whereas yellow fever is acute to a degree. Sir Ronald Ross's suggestion is that, whereas in malaria the parasite resides in man, in yellow fever the Stegomyia is the true host and man an occasional host only; hence it is the presence of infected Stegomyia in sufficient numbers that determines the appearance of yellow fever in any district.

HAROLD SEIDELIN, M.D. (Liverpool): The endemi-

city of yellow fever on the West Coast has long been believed in and recognized, and the recent repetition of the fact by Sir Rubert Boyce seems to have occasioned a commotion which it is difficult to understand. The conditions obtaining in West Africa are similar to those met with in Yucatan, where until lately he had worked. The natives there are considered immune, but it is admitted that the immunity is not absolute. When returning from a prolonged stay abroad, the native of Yucatan fears a recurrence of the disease, under the belief that, owing to absence from the country, he is no longer immune. In Yucatan, in Havana and elsewhere in the West Indies, immunity from attacks in childhood is firmly believed in by residents in these countries. The strongest proof of the endemicity of yellow fever on the West Coast of Africa is the absence of epidemics. Dr. Seidelin holds the opinion that all newcomers to a yellow fever district contract the disease, but only the very severe or fatal cases are officially reported. On his arrival with his wife and two children in Yucatan, the children were attacked by a febrile disorder, his wife was ill for a few days, and Dr. Seidelin himself became very ill, and yellow fever was diagnosed though not officially confirmed. He believed the whole family had yellow fever, all mild, except in his own case. He found many such examples of attacks of the kind during his stay in Yucatan. Another proof was forthcoming: an English lady came to reside in his house, she was seized with yellow fever, but his own family did not contract the disease. He believed they were rendered immune by the attack they had on arrival. Dr. Seidelin cited instances of yellow fever being contracted in districts where the disease had not declared itself for years, showing an unappreciated endemicity.

The period of infection of the blood in yellow fever is stated to be limited to three days, but the evidence of this dogma is not substantiated.

*A Possible Parasite.*

Dr. Seidelin stated that he had demonstrated the presence of characteristic bodies in the blood of yellow fever patients at a much later stage of the disease than three days. He believes that the bodies he mentions are parasites, and many protozoologists agree with him. From the evidence available it would seem that there must be a good deal of endemic yellow fever in West Africa. The difficulty is to obtain an exact method of diagnosis; until that is possible, real advance in our knowledge of yellow fever is at a standstill.

A. T. CHALMERS, M.D. (Ceylon): In the course of his remarks, Dr. Chalmers referred to the excellent work done by the late Sir Rubert Boyce and the late Drs. Elliott and Murray. Dr. Chalmers was of the belief that yellow fever is endemic on the West Coast, and quoted from older writers as to the endemicity, and gave the experience of the epidemic at Saltpond, in which instance it is difficult to believe it was introduced from without. Certain cases of bilious remittent fever certainly did not show malarial parasites in their blood and might have been yellow fever. In practice he found that the severe cases disappeared as a rule from any neighbourhood when sanitary and anti-mosquito methods were carried out.

Major R. W. H. JACKSON, M.D., R.A.M.C.: During the Ashanti War of 1873 yellow fever was frequently referred to in the medical reports of the campaign, and its presence recorded. When in the West Indies a ship arrived at Kingston from Pará, with all the crew incapacitated except two. One man had been landed at Trinidad, where he was stated to have yellow fever, and three men were buried at sea; yet, although the men on board seemed to him to be suffering from yellow fever, the local authorities did not agree with him. When quarantine regulations are too strict they defeat their own ends, for smallpox becomes "eruptive fever," yellow fever is put down as "pernicious malaria," and plague is diagnosed as "climatic bubo."

R. H. KENNAN, M.D. (Sierra Leone), gave an interesting account of his experiences in Sierra Leone.

J. W. MARTIN, M.D.: From experiences gained on the West Coast, Dr. Martin believed that yellow fever is endemic there. There are cycles of severity. It seems probable that many cases of bilious remittent fever are really cases of yellow fever, for in many so-called malarial attacks quinine was useless.

HERBERT P. COLE, M.D. (Mobile, Alabama, U.S.A.): In 1908 Dr. Cole recommended a serum-therapy in yellow fever. The injection of defibrinated blood, with the usual precautions, taken from cases recently recovered from yellow fever, might be tried with persons apparently dying of this disease. In the event of negative hæmolytic and agglutinative experiments, direct transfusion from recently recovered cases to persons seriously affected with yellow fever would serve not only to combat the anæmia, but also convey an acquired immunity principle at the same time.

M. CAMERON BLAIR, M.D. (Northern Nigeria), considered that yellow fever is perhaps as often mistaken for bilious remittent fever as the converse. He had never diagnosed any of the illnesses he had seen in Northern Nigeria as yellow fever. He quoted cases of bilious remittent fever which might be considered to resemble yellow fever, but no immunity was conferred as the attacks recurred. In some of these cases, however, malarial parasites were found in the blood.

G. ROME HALL, M.D. (London): Dr. Hall stated that at Lagos in 1893 a severe epidemic occurred, in which ten Europeans died, nearly all the Syrians and several missionaries. The symptoms were: vomiting of blood, hæmaturia, and, after a day or two, jaundice. These cases were returned as bilious remittent fever, or in some cases blackwater fever.

Within twelve months 31 Europeans died out of 150 resident in Lagos. Three missionaries left Lagos for the Niger during the year, of whom two died, and the doctor on board, who had seen yellow fever in the West Indies, diagnosed their illness as yellow fever. In 1895 a fatal form of fever prevailed on the Fanti coast, and at Elmina three out of four of the official staff died. Cape Coast Castle and Saltpond were also swept by the malady. Three

*post-mortem* examinations made revealed gastro-enteritis, parenchymatous nephritis, and splenic enlargement. In 1901 Dr. Barker reported yellow fever at Cape Coast; of eight cases (white) attacked, seven died; and in 1902 Dr. Hall also reported the disease. In 1910 a conflict of opinion arose about the Sekondi outbreak, the pathologists not agreeing with the clinicians. Dr. Hall believed these cases to have been yellow fever.

Professor SIMPSON, Dr. A. K. WISE, and the PRESIDENT also spoke, and Dr. STEPHENS replied.

### RECENT EXPERIMENTAL WORK IN SLEEPING SICKNESS.

By A. G. BAGSHAWE, M.B.

*Director, Sleeping Sickness Bureau, London.*

The question of the transmission of the *Trypanosoma gambiense* by other species of tsetse-fly than the *Glossina palpalis* has frequently been raised. The question could not be answered because in the areas where sleeping sickness was found other species of tsetse existed side by side with *G. palpalis*. It was only when Dr. Kleine, working with laboratory-bred flies, was able to show that transmission was not direct, but after development in the insect's body, that a basis on which to act was formed.

It was stated by Drs. Kleine and Tante, in 1909, that although the *T. gambiense* might begin its development in *G. morsitans*, it could not be completed in that fly. Since then, however, sleeping sickness has occurred in Nyasaland and Rhodesia, where *G. palpalis* does not occur but *G. morsitans* is common. An expedition has recently been sent to these countries to inquire into the question. On July 18, 1911, however, a communication was received from Dr. Tante that he had succeeded in transmitting trypanosomes to monkeys by *G. morsitans*.

## *Friday, July* 28, 1911.

### SANITATION OF VILLAGES AND SMALL TOWNS, WITH SPECIAL REFERENCE TO EFFICIENCY AND CHEAPNESS.

By Professor J. W. R. SIMPSON, C.M.G., M.D.

To be successful in getting his proposals carried through for the better sanitation of the community he is responsible for, the medical officer of health should possess a fair knowledge of the cost of sanitary appliances and of labour. When dealing with villages cheapness is essential. To allow sanitation to drift until disease appears in epidemic form is a very common policy, but one which is costly to a degree. There is little use in the discovery of scientific truths unless they are acted upon promptly and applied efficiently. Small towns and villages are apt to be neglected, and the temporary sojourner is likely to catch whatever is going in the way of infectious disease.

A removal policy after insanitary conditions have arisen is the preventive policy of to-day. New towns, not more than a few years old, are begun on the same insanitary lines as the old, and form into unhealthy areas. When an epidemic arises, large sums of money are required to rectify mistakes and remove the standing insanitary conditions. The drainage, the water supply, crowding of huts, houses, and people, abundance of flies and mosquitoes, and all the elements necessary for the continuance of the disease are at hand. To remedy these, money is recklessly spent, whilst all that was necessary was the weekly wage of a few coolies, employed regularly and systematically throughout the year. To attempt an active policy without adequate guidance and advice is sure to end in disaster; and a policy of action without advice at the proper time, entailing enormous expense, is largely responsible for the idea that all sanitation is expensive, and must be deferred until the last moment. In the Tropics new sites for cities have sometimes thus been selected and built upon, with the result that, owing to the enormous amount of disease and mortality, abandonment of that city is necessitated, and the building of a new one. Mistakes cost more to correct than even the initial construction in many instances. The usual plan is for the Government, whether central or municipal, to ask for sanitary advice after the work has been accomplished. The doctor is called in when the patient is ill, so the sanitary officer is also called upon to give advice when the damage is done. He should have been consulted when the scheme was on paper, and also when it was being constructed he should have been asked to control and superintend.

The adoption of a preventive policy is an urgent necessity of tropical sanitation. With the European quarter separated from the native, there is a tendency to neglect the native quarter, and both quarters will suffer. In the Tropics administration must go hand in hand with the established discoveries of research: if not, of what use is all our labour?

W. T. PROUT, C.M.G. (Liverpool): In villages in tropical countries the medical officer, the Public Works Department, and the natives ought to co-operate. This is too often not the case. Dealing with natives in the matter of sanitation is a difficulty; it is almost impossible to bring the adult native to see any good in changing his methods, and the only hope is the education of the children in schools in elementary hygiene. It is a mistake, however, to throw aside native sanitary methods altogether, for they are often based on principles suitable to the locality. A chart of "Don'ts" should be hung up and explained in all schools in the Tropics.

Dr. A. J. CHALMERS (Ceylon) drew attention to the importance of superintending coolie quarters, of seeing that camps, barracks, or villages which are being laid out to accommodate plantation labourers are constructed on sound sanitary principles. The hut or house, the area around each, the width of the streets, the water supply, the drainage, and the disposal of excreta ought all to be carefully considered before coolies are allowed to settle on a plantation.

ANDREW BALFOUR, M.D. (Khartoum): The necessity of having properly trained certificated British sanitary inspectors to do work in Crown Colonies was an urgent matter; without them work cannot be thoroughly and honestly done. These men ought to be trained and examined in tropical hygiene before

going out. Dr. Balfour also drew attention to the value of incinerators for the destruction of refuse and excreta for villages, especially in dry climates.

M. CAMERON BLAIR, M.D. (Northern Nigeria), considered that the religion of all natives, however crude, tended towards the betterment of sanitation in tropical villages and towns, the Mahommedan religion especially favouring hygiene—measures such as frequent washing, the care bestowed on the food, and the elimination of the pig from amongst the domestic animals, all tended towards better sanitation.

Lieutenant-Colonel A. H. NOTT, I.M.S., stated that the difficulties of applying modern sanitation in tropical countries seemed insuperable. The native ways were not our ways, and to eradicate prejudices and customs of hundreds of years' standing was a difficult task. The only hope lay in training the young people in the schools.

DAVID J. GALLOWAY, M.D. (Singapore): The question of religion in dealing with sanitation is a natural one, for religion is always more or less of a sanitary code. Dr. Galloway said he found nothing in the Mahommedan religion which tended to help towards better sanitation, but much that thwarted its progress. The disposal of excreta and the frequent ablutions both tend to pollute the water rather than help sanitation. The absence of the pig and the dog as scavengers was detrimental, and the ritual of washing the dead tended to the spread of disease, especially cholera. A good deal had been done in the Straits Settlements in the way of promoting sanitation; especially does this refer to the planting industry, the rapid rise of which brings many thousands of labourers to be dealt with. A Bill has just been passed which sets forth in precise terms how groups of coolies, whether in hundreds or thousands, should be accommodated, and the sanitary needs of the camp or village provided for.

Major R. W. H. JACKSON, R.A.M.C. (Retired): Customs and caste prejudices, in India especially, are no doubt opposed to sound sanitation in many respects. He described how he dealt with a cholera camp in Scinde, where were gathered together, owing to famine elsewhere, a large number of natives of different nationalities. By humouring and utilizing as far as possible caste prejudices and customs he was able, with the application of a few simple sanitary measures, to get the people under his charge to work with him and not against him in dealing with medical and sanitary matters, for the good of the camp.

R. H. KENNAN also spoke as to the necessity of villages being seriously considered in any scheme of hygiene for the benefit of a district.

## THE RÔLE OF THE INFECTIVE GRANULE IN CERTAIN PROTOZOAL DISEASES.

By ANDREW BALFOUR, M.D.

*Director of the Wellcome Tropical Research Laboratories, Khartoum.*

In spirochætosis and trypanosomiasis, what may be called the infective granule probably plays an important *rôle*. It marks a stage in the life-cycle of the parasite, explains in some measure latent infections and possible relapses and serves to clear up the obscure mechanism of relapses. The existence of the infective granule is no new discovery; Breinl in 1907 observed encysted forms of *Sp. duttoni* becoming indistinct and ending in a few small red granules. These, Breinl said, could pass through a Berkefeld filter; from them new generations of spirochætes evolved, and thus gave rise to fresh infection.

In rabies, pleuro-pneumonia and cholera, these granules are met with. Leishman showed that *S. duttoni* broke up in *O. moubata* to form granules which proved to be infective, and from which young forms of spirochætes arose. Balfour has obtained similar results with the fowl spirochæte of the Sudan in *Argus persicus*, the fowl-tick. Other observations having a similar bearing are Carini's intra-corpuscular and granule-like shape of a frog trypanosome; Chagas and Buchanan's observations on red cell trypanosome inclusions; Theiler's *Anaplasma marginale;* Gonder and Meyer's work on the life-cycle of *Theileria parva;* M. Carter's work on the parasite of oriental sore; and "cryptic trypanosomiasis," in apparently healthy cattle in England, America, France, Germany, Algiers, Tunis and Brazil. By a study of these it occurred to Balfour that in trypanosomiasis there is a missing link, and it would seem as though Captain Fry had discovered that link. Balfour and Fry's observations tend to show that the infective granule is shed by living parasites naturally, and also when the parasite is influenced by a toxic drug, (*e.g.*, salvarsan, by which the phenomenon is intensified).

### CONCLUSIONS.

#### I.—FOWL SPIROCHÆTOSIS.

*Spirochætes in the Fowl or Chick.*

(1) At the crisis spirochætes are found shedding granules.

(2) The phenomenon is greatly intensified if salvarsan be given.

(3) The granules are spherical and motile.

(4) They are resistant and are not easily killed by salvarsan.

(5) A certain number under certain conditions appear to enter the red cells.

(6) These granule inclusions undergo development, pass, indeed, through a stage analogous to that of schizogony, and finally the schizont breaks up into tiny merozoites, which are discharged into the blood-stream.

*Spirochætes in the Tick.*

(1) In the contents of the intestinal sac, and in the cœlomic fluid the spirochætes undergo granule-shedding, so that eventually nothing but granules and empty periplasts remain.

(2) The granules pass to the alimentary diverticula, Malpighian tubes, ovary, eggs and salivary glands of the tick. The Malpighian tubes are the seat of election.

(3) Under certain conditions these granules develop into thick vibrio forms, and also into what seem to be young spirochætes.

(4) If these granules are injected into a chick, the bird develops spirochætosis. If a chick be fed on a number of ticks containing only granules, the bird also develops spirochætosis.

(5) It is probable that fowls are often infected naturally *per os*, and possibly also by the entry of granules or young spirochætes into the wound made by the tick when feeding.

### II.—Syphilis.

*Treponema pallidum* is a granule-shedder. Salvarsan greatly stimulates this action. The granules are resistant. The spirochætes, such as *S. refringens*, often associated with the spirochætes of syphilis, are also granule-shedders. It is probable that these granules cause tissue irritation, are responsible for latent infections, for failures in therapeusis and possibly, to some extent, for the tertiary lesions of syphilis. A method will have to be devised whereby they can be destroyed either in the parent spirochæte or in the tissues.

### III.—Trypanosomiasis.

Captain Fry has shown that both *T. brucei* and *T. evansi* shed living granules. These become what are known as plasmodial masses out of which eventually trypanosomes are developed. In all cases these granules are probably of a spore nature. They are resistant. It is not easy to stain them, save when in red cells or in tick tissues, by the Romanowsky process. They are best demonstrated in the blood and tissues by one of the silver impregnation methods, notably Yamamato's modification of Levaditi's tissue stain.

Dobell holds that the spirochætes are best placed in a group by themselves which he has named Spirochætoidea. Closely allied, however, are the trypanosomes, and whether we call them protozoa or not, I believe that granule-shedding will be found to be a phenomenon presented by many of the pathogenic, and possibly also by some of the non-pathogenic, Protista, to use a term which is non-committal and yet sufficiently descriptive.

## Pellagra: Treatment by Direct Transfusion of Blood.

*Review of Thirty-one Cases.*

By Herbert P. Cole, M.D.
*Mobile, Ala., U.S.A.*

*Abstract.*

Pellagra, a sub-tropical disease with marked tropho-neurotic manifestations, has been of increasing prevalence throughout the southern United States of America in recent years. The cases in America have been of unusual severity, and in the severe type have resisted all accepted medical treatment. The patients succumb through myocardial and renal changes associated with anæmia, primarily through the gastro-enteric lesions.

In August, 1908, in an effort to combat the severe anæmia in a terminal case of pellagra, we employed (so far as we are able to ascertain) transfusion of blood in pellagra for the first time. This patient, moribund at the time of operation, made such an immediate improvement and rapid recovery as to suggest this treatment in further cases. In collaboration with my associate, Dr. Gilman J. Winthrop, we have since transfused thirty patients in the terminal stages of the disease.

Only cases resisting all other forms of treatment have been transfused. To illustrate the type of cases it is sufficient to state that several were moribund at the time of operation, and one patient died on the railway train twenty minutes before arriving at Mobile for transfusion.

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|---|---|
| Patients transfused (aged 3 to 64) ... ... | 31 cases |
| Recoveries (58 per cent.) .. ... ... | 18 ,, |
| Deaths (42 per cent.) ... .. ... .. | 13 ,, |
| Relapse (3.2 per cent.) ... ... .. ... | 1 case |

The relapse occurred two years after transfusion. This was an institutional case exposed to reinfection.

| | |
|---|---|
| Temporary improvement, followed by death... | 4 cases |
| No improvement following transfusion ... | 9 ,, |
| Complications incompatible with recovery ... | 3 ,, |

Cases incompatible with recovery: One, complicated with tuberculous peritonitis, died one month after operation; a second, a male child, aged 3, showed distinct improvement after operation, but died eight days later from intestinal perforation; a third, a male, aged 16, who had bilateral pneumonia at the time of operation, died one week later having shown no improvement.

Complications presenting insufficient flow of blood followed by death: Two cases.

It will be noted that five of the thirteen cases may well be excluded. Two received an inadequate amount of blood at transfusion, and three were moribund at the time of operation. Excluding these cases, the mortality-rate in the operative cases would be 25 per cent. as compared with 42 per cent. We include, however, all deaths in the series.

### Conclusions.

We have noted no ill-effect from transfusion in any of the cases. We may safely resort to transfusion in the severe type of cases that are steadily retrogressing under approved therapeutic measures.

We have noted no advantage in employing a donor who has recovered from pellagra in comparison with the donor who has never had pellagra.

There is apparently no advantage in the use of a relative for a donor as compared to the use of a non-relative.

The recoveries (58 per cent.) following transfusion in the grave type of cases compares most favourably with the recoveries (10 to 20 per cent.) in the same type of cases, in which other therapeutic measures are employed.

We are unable to say that there is any immune principle transferred by the operation. It is probable that any beneficial effects result through restoration of the vascular contents primarily.

A small percentage of cases apparently receive no benefit whatsoever.

Without careful selection of the cases, and unprejudiced conclusions, this procedure will fall into undeserved ill-repute.

Dr. F. M. SANDWITH remarked that transfusion has been brought before us as a potential form of treatment in connection with pellagra and the attendant anæmia. May not the anæmia in leprosy be due to other causes, such as ankylostomiasis? Dr. Cole's transfusion treatment had been tried in advanced and desperate cases of leprosy, and as these promised well there was hope that the good effects would be still more marked in less serious cases. It would be well also to contrast say, fifty cases treated by transfusion, with fifty treated by salvarsan. Dr. Cole's experience would seem to be in conformity with Dr. Sambon's idea of a protozoon as a cause of pellagra.

Dr. LOUIS SAMBON drew attention to the phenomenal increase of pellagra in the United States. Although the disease was first announced in North Carolina, as late as 1908, there has been a death-rate of 500 to 2,000 cases annually. Siler, Lavinder, Blue, Wood, Zeller, Nichols and others have all testified to the increase. Zeller states that the "corn experiment" proved that the amount of corn eaten has no relationship to the prevalence of pellagra. Dr. J. Williams, Jamaica, has placed on record, that it is his belief that maize, damaged or otherwise, is not the sole cause of pellagra. The one-time theory that salt had to do with the cause of pellagra has also been given up. Dr. S. R. Roberts, Atlanta College, Georgia, after an epidemiological survey of Georgia, came to the conclusion that pellagra existed there in regions similar to those which Dr. Sambon met in Italy, namely, near streams in which the simulium flourishes. Dr. E. J. Wood writes concerning Dr. Sambon's idea of pellagra being carried by a simulium. "I can confirm your statement now regarding the geography. I have looked into the habitat of the buffalo fly (simulium) and find that wherever pellagra is known, there the buffalo fly is a pest." Dr. Hanscell, writing from Barbadoes, finds that in the two places where pellagra prevails in Barbadoes, the topographical conditions are similar to those found by Dr. Sambon in Italy. Professor Babes, of Bukarest, one of the staunchest supports of the "maize theory," has become converted to the parasitic and insect-conveyed theory of Dr. Sambon. By accepting the parasitic origin of pellagra we have this disease brought into line with similar brain disorders due to parasitism, such as syphilis and tuberculosis, and like sleeping sickness brought about by the bite of a fly.

Mr. JAMES CANTLIE stated that the Second Field Commission for the Investigation of Pellagra was about to start for the Continent. The Commission consists of Dr. Louis Sambon, M.D., Parasitologist to the Wellcome Physiological Research Laboratories, and Lecturer in the London School of Tropical Medicine, and Dr. Albert T. Chalmers, M.D., F.R.C.S., D.P.H., Registrar and Lecturer on Pathology and Animal Parasitology, Ceylon Medical College. The Commission will be joined *en route* by Professor Haase, of Memphis, U.S.A., Dr. Cole, of Atlanta, U.S.A., and Dr. Martinez, Yucatan, Mexico. The Commission assemble at Vienna on August 15, and proceed thence to the pellagra-infected districts around Klausenburg and elsewhere in Hungary, where a stay of some two or three weeks is contemplated. The next field of investigation is the Australian Tyrol, in the neighbourhood of Rovereto, more especially where pellagra is said to be widely spread. After a sojourn of from two to three weeks in the Tyrol, the next place to be visited is the Asturias, in Northern Spain. On the homeward journey the South of France may also be visited if time and opportunity allow.

The Governments of the several countries mentioned have promised a most cordial welcome to the Commission, and the scientists interested in pellagra are ready to co-operate with the British and Americans who form the party.

The money defraying the expenses of the previous Field Commission in Italy in 1910 was provided by subscriptions got together by the Pellagra Investigation Committee. The results obtained by Dr. Sambon in 1910 were so important and so encouraging that a second Field Commission was determined upon, and Mr. Henry S. Wellcome has most generously come forward and supplied the funds necessary for the work to be carried on.

It is well known that Dr. Sambon refutes the idea that pellagra is due to the consumption of damaged maize. His conviction is that a parasite carried by a fly—a simulium—is the factor involved. So convincing were Dr. Sambon's conclusions as the result of this visit to Italy in 1910 that many upholders of the "maize theory" of pellagra ætiology have become converted to the parasitic theory of the disease.

The rapid extension of pellagra in the United States, according to recent reports, is becoming alarming, and the more the effects of this insidious complaint are studied the more acute has become the necessity for a deliberate investigation of the disease.

Dr. Sambon's previous report was stated by competent judges "to be a fine piece of scientific work," and we look forward to the work of the present Field Commission with the greatest interest.

## DEMONSTRATION OF SPECIMENS RELATING TO THE CULTURE OF THE LEPROSY BACILLUS.

By H. BAYON, M.D.
*Cragg's Investigator, London School of Tropical Medicine.*

Hansen's *Bacillus lepræ* is looked upon as the causative agent of leprosy in the human being. Although we have no conclusive proofs as to its primary ætiological *rôle*, and in spite of some apparently direct negative evidence regarding its agency, it would appear quite safe to accept this bacillus as the cause of leprosy in man. The constant presence of the bacillus in leprotic tissues and secretions is not definite proof of its being the actual cause, for in other ailments, such as hog cholera, the apparently constant presence of a germ does not constitute a definite conclusion as to causative agency. Up to quite a recent date acid-fast rods were considered to be diagnostic of a *B. tuberculosis*, a *B. lepræ*, or a smegma bacillus: it is now known that these rods are plentifully distributed in Nature as well as in man in whom neither tuberculosis nor

leprosy are present. The diagnosis of leprosy by finding acid-fast rods in the nasal mucous membrane is confuted by the fact that in several ailments, and also in healthy persons, the same rods have been met with in the nostrils.

Dr. Bayon has succeeded in growing the bacillus in media of several kinds. Dr. Bayon's conclusions are:—

(1) It is not sufficient to culture an acid-fast or other organism from one or several cases of leprosy to enable a statement to be made as to its relationship to the disease. This must be the result of complete animal experiments and extensive serological tests.

(2) It is possible to culture from cases of human leprosy an acid-resisting diphtheroid which acquires acid-fast properties on being injected into mice or rats. It is possible to regain the germ by culture from the organs of the animals infected as an acid-fast rod. Re-injected into mice or rats it causes the identical changes of genuine spontaneous rat leprosy and very striking analoga of the glands and organs of human cases.

(3) No special medium can guarantee a culture from a case of leprosy. The growth depends upon circumstances which we do not so far know and cannot control. This applies to the *B. leprœ* in its acid-fast shape, as seen in lepromata. The most favourable media appear to be either placental-extract agar or horse-serum nutrose agar with the addition of 2 per cent. ground up smegma bacilli.

(4) Kedrowsky's work on the variable morphology and staining properties of the lepra-bacillus appear to be confirmed.

(5) Agglutination, precipitation, complement deviation and percutaneous tests can be used to prove the relationship of acid-fast or other germs cultured from cases of leprosy.

(6) Rat and human leprosy appear to be identical diseases, it is therefore possible that the germs in both cases can be transmitted from one to the other given an appropriate intermediary. As rat leprosy appears to be endemic in England, this may be an explanation of the sporadic cases in people who have never been abroad.

### *Rat and Human Leprosy.*

It is quite possible that the human and rat disease are to each other in the same relation as bovine and human tuberculosis, but on the other hand we cannot exclude that they are caused by the identical germ. Have we not a striking analagon in plague? Cannot plague smoulder among rats for years and years and then suddenly appear as an epidemic? May not this chronic disease in rats be the survival of the endemic leprosy of the middle ages? George Dean, in his paper on rat leprosy, seems to take this point of view into consideration, but concludes that so far we have not sufficient evidence to decide the question. There is some further proof in favour of the identity of human and rat leprosy. The tissues under the microscopes enable one to distinguish the genuine, spontaneous leprosy of the rat from the experimental variety in the mouse and rat, which was produced by a germ cultured from man.

Regarding the transmission of leprosy I am trying to collect evidence to show that according to the manner in which the infection takes place, the disease is apt, at least in the beginning, to show different features. The nodular type appears to me to be transmitted by an arthropod capable of burrowing into the skin, possibly the *Demodex folliculorum*, as suggested by Borrel. The maculo-anæsthetic type may possibly be due to direct contact infection.

Acid-fast bacilli have been found in the lice of leprous rats. However, this is by itself not sufficient evidence to incriminate syphonaptera as disease carriers in this connection. Lepra bacilli can be found in the blood of lepers during the rises of temperature that occur frequently during the course of the disease. At other times, if the blood is taken from a spot free from nodules, none are to be found.

This fact may possibly explain why Donald Currie did not find any acid-fast bacilli in the 493 specimens of *Culex cubensis* he examined thirty minutes to three hours after they had fed upon leprous patients.

Concerning the cases which have contracted leprosy without ever having left England or a country where leprosy is unknown, may we not suggest that by some extremely fortuitous circumstance they may have been stung by some arthropod ectoparasite off a leprous rat? The sarcoptes common to rodents will attack man, according to Brumpt.

## The Mechanism of Production of Suppression of Urine in Blackwater Fever.

By W. Yorke, M.D.
*Director, Runcorn Research Laboratory, Liverpool.*

In an interesting paper Dr. Yorke discussed the question of whether the occurrence of hæmoglobin free in the blood plasma, and its subsequent elimination by the kidneys, is sufficient to produce suppression of urine through mechanical blocking of the renal tubules, or whether a nephritis or nervous inhibition of glomerular secretion is to be regarded as the essential factor in the development of this condition in blackwater fever. He stated that the question has not been definitely determined.

Dr. Yorke found the urine was suppressed in a number of animals experimented upon by reducing the blood-pressure of the rabbits experimented upon, partly by keeping the animals on dry food for twelve hours previous to the injection of hæmoglobin and also during the experiment, and partly by bleeding the animals to a moderate degree from the external jugular vein. In order to obviate as far as possible the diuretic action of sodium chloride, the strongest obtainable solution of hæmoglobin was employed. According to the number of injections of hæmoglobin corresponding changes in the kidney were noted, both in the appearance of the kidney and in the contents and condition of the renal tubules, when examined microscopically.

### *Conclusions drawn from the Experiments and their Bearing upon the Treatment of Suppression of Urine in Blackwater Fever.*

It is evident from the experiments that, under certain conditions, the mere passage of hæmoglobin

through the kidneys of a healthy animal is sufficient to cause suppression of urine owing to occlusion of the lumen of the renal tubules by plugs of granular material derived from the hæmoglobin. The process is considerably facilitated by any factor which tends to lower the blood-pressure of the animal and, as a result, the secretion of water by the malpighian capsules. On the contrary when the blood volume is sustained by the injection of saline solution and by feeding the animal on moist food a large amount of hæmoglobin (41 grm.) may be injected without any tendency to suppression of urine. It appears that these observations have an important bearing upon the treatment of suppression of urine in blackwater fever in man. On the earliest sign of any diminution in the volume of urine voided radical measures must be adopted. The patient should be given large quantities of fluid by the mouth if possible or rectum and cardiac stimulants such as digitalis and caffeine administered. Should these not produce a copious flow of urine recourse ought at once to be had to large intravenous injections of normal saline solution. Our experiments indicate that it is useless delaying the adoption of these measures until suppression of urine has actually commenced. At this stage, it is highly improbable that any procedure will be adequate to displace the casts. This is in agreement with the clinical observation that late intravenous saline injections usually fail to relieve suppression. When suppression has once developed and continued even for a short period the injury done to the kidneys is such that the result must of necessity be almost invariably fatal.

## SANITARY MEASURES IN PERU.

### Yellow Fever.

A correspondent writing to the South American Supplement of the *Times*, August 29, 1911, gives the following account of the sanitary measures taken in Peru for the prevention of yellow fever:—

About five years ago the United States Marine Hospital Service sent one of its sanitary officers to Guayaquil, in Ecuador, and another to Callao, in Peru, to establish for these countries a system of quarantine against vessels arriving from infected ports, and at the same time to supervise vessels bound to Panama.

Some three years later the United States sanitary officer was withdrawn from Callao, and the sanitary affairs were entrusted to a Peruvian doctor, who was, until recently, also responsible to the Peruvian authorities for the sanitary measures at Callao.

There is now a sanitary branch in Lima under a chief styled the "Director de Salubridad" (Director of Public Health), who, in the exercise of his duties, unfortunately places all sorts of obstacles and restrictions in the way of commerce and foreign shipping.

The steamers of the principal shipping companies on the West Coast of South America engaged in the coasting trade carry a Peruvian Government sanitary officer, paid by the ship at the rate of £25 per month, all found, in return for whose presence on board a few sanitary impositions are remitted.

Each ship on entering Peru either coming from Chile or Ecuador is fumigated with dioxide of sulphur by the Clayton machine with which each ship is provided, and which causes a good deal of damage to cargo and ship's fittings. The climax is, however, reached when a ship arrives at Payta, in Peru, from Guayaquil, in Ecuador. In order to prevent damage by the fumes to the furniture and fittings of the saloons and state-rooms, these places are closed up and sealed by the sanitary inspector on board before the ship's arrival at Guayaquil, and are kept closed until after her return to Payta, and it is only thus that they can be exempted from fumigation on re-entry into Peru. Steamers calling at Guayaquil make that port their terminus. It is 220 miles distant from Payta, which is the last port of call in Peru for vessels bound north. It follows that the saloons and state-rooms have to be kept closed for two or three days, with great discomfort to those on board, who have to take their meals on deck. On the ship's return to Payta, the port sanitary officer comes on board, examines the passengers and crew, closes all places in the ship which cannot be fumigated at sea, such as the engine-room, stokeholds, pantries, and galleys, and sees them fumigated for some hours, after which, if all is well, he receives the ship, when everything is opened and ventilated and the ship is allowed to work cargo in quarantine, a restriction which lasts for six days.

### Carriage of Fruit from Guayaquil.

The steamers arriving from Guayaquil bring as a rule about 300 tons of fruit on deck (bananas and oranges), mostly in transit for Chile, and this fruit has to be stowed on the awning deck, which is the highest deck of all. This is said to be done to prevent any mosquitoes being harboured among the fruit. A great deal of freight which could be carried on the main deck is thereby lost to the shipping companies.

All this is done to prevent the importation of yellow fever into Peru, but anyone who has made a study of the question, and has had the opportunity of constantly going to and fro, positively knows that the present measures are all useless for the purpose for which they are intended, and are the cause of loss of time and money to commerce and shipping, of discomfort to the travelling public, and of a good deal of friction with the neighbouring Republics.

The natives of the town of Guayaquil are immune from yellow fever, but the people from the interior of the country, as well as foreigners, are subject to it. It is very seldom that the hospital is without a case or two, and at times there are numerous cases and several deaths.

As is well known, yellow fever is conveyed by the bite of the infected mosquito, *Stegomyia calopus*, which exists throughout the year in Guayaquil, irrespective of the seasons. Happily it does not fly far from its habitat, and usually lives and dies in the same place. Passengers and crews arriving

at Guayaquil get badly bitten, and suffer great discomfort from the bites for days afterwards. I have been calling here constantly for the last eighteen years, and in no single instance has a case of yellow fever ever broken out on board (except among those who went on shore), even though nearly everyone on board had been badly bitten by mosquitoes. This fact only confirms what I maintain, namely, that the yellow fever mosquito does not fly far from its habitat, and therefore does not invade the ship anchored in mid-stream, and especially so nowadays, when the steamers anchor off the slaughterhouse two miles away from the town. On the representation of the United States Marine Hospital Service, the Ecuadorian Government conceded the privilege to steamers bound to Panama or to Peru of anchoring off the slaughterhouse, in order to prevent steamers bound to the latter country from being subjected to all sorts of unjust impositions. About four months ago another decree was issued from Lima stating that if steamers anchored about a mile further down the river from the slaughterhouse, the saloons and state-rooms, if left open, would not be subject to fumigation, and the fruit could be stowed on the main deck. The first ship that arrived at Guayaquil after this decree anchored at this spot, but the Ecuadorian port authorities quite rightly refused to receive the ship until she proceeded to the proper anchorage.

The last decree mentioned above implies in its preamble that during the rainy season, when the mosquitoes at nightfall swarm on board from the swamps and marshes, *Stegomyia* comes off to the ship as well, and that during the dry season, when the swamps are dried up and there are no mosquitoes there, *Stegomyia* does not come off to the ship or does not exist in Guayaquil.

How different matters are in reality, and how erroneous are all their suppositions in Lima!

For years on board ship I have searched in vain for a single specimen of the dreaded yellow fever mosquito, and have even gone so far as to offer from time to time £5 reward to the sanitary inspector on board who could find me one in the ship, but, in spite of this, there has always been a negative result.

### Unnecessary Precautions.

It therefore follows that if those on board coast steamers anchoring two miles away from the town are badly bitten by mosquitoes and yet do not get yellow fever, and if it is impossible to find on board a single specimen of *Stegomyia*, steamers calling at Guayaquil should be freed from these stupid restrictions and ridiculous measures, and the only precaution necessary is to prevent persons who have been on shore at Guayaquil from landing in Peru within six days from their departure from that port.

The style of construction of the mail and passenger steamers on the West Coast of South America is such that it would be a most difficult matter to fumigate efficiently such ships in order to destroy any mosquitoes that may have come on board. There is so much superstructure above the tonnage deck that even after the holds and every other enclosed space have been fumigated there are still left innumerable nooks and corners where mosquitoes could take refuge. The fruit on deck cannot be fumigated without its complete destruction, and yet this is a more likely place for mosquitoes to lodge than in any other part of the ship. Luckily for everybody on board *Stegomyia* is conspicuous by its absence.

To illustrate further the absurd restrictions steamers have to put up with on entering Peru I shall now describe what happens after the ship has been received at Payta by the port authorities. The company's agents and shippers are allowed on board to transact what business they may have, and must return on shore with as little delay as possible. On the other hand, passengers are allowed to embark for all ports in Peru and, with the exception of those from Guayaquil, to disembark at any subsequent port. These new passengers intermingle with those from Guayaquil, sleep in the same cabins, and frequent any part of the ship, in spite of which they can land at any port from what is considered for six days an infected ship. A company's agent or a shipper is only allowed to go to the ship's office, and then only on sufferance, some of the inspectors on the ship even going so far as to forbid them access on board. How can the Director of Public Health in Lima explain matters so incompatible? To say the least it indicates utter ignorance of the whole principle, or imposition of ridiculous regulations.

The United States Marine Hospital Service is a good deal to blame for this, as it has taught the Peruvians too much and at the same time too little. A little knowledge is dangerous, and this statement is in this instance the whole secret—they try to overcome the effect without considering the cause.

Owing to the climatic conditions of the seaport towns and villages of Peru, it would be a simple matter to eradicate *Stegomyia calopus*, which exists more or less in all these places. Very few of them have any drainage or potable water, and the drinking water is usually kept in barrels, which is the usual breeding place of the domestic mosquito.

There is no rain on the coast, and by screening all water deposits with wire gauze the mosquito would soon cease to exist, after which the spread of yellow fever would become an impossibility. This is the *crux* of the question; but with the exception of a faint attempt at Callao in this direction a few years ago nothing further has been done in the matter. If the Peruvian authorities are incapable of doing this themselves, let them ask the United States Marine Hospital Service to do it for them, and I am confident that in less than six months *Stegomyia calopus* would cease to exist in the coast towns of Peru. This indeed would be money spent to a good purpose, and the result would be far-reaching in its beneficial effect upon the country.

## Original Communications.

# ON ENTERIC FEVER IN SOUTH INDIA.

*A Thesis for the Degree of M.D.Dunelm.*

By Percy Edward Turner, M.D., B.S.Dunelm, M.R.C.S., L.R.C.P.Lond., D.P.H.Oxon.

My attention was arrested during a perusal of the *British Medical Journal* in 1907 by a passage [1] in the review of Major Ernest Roberts' "Enteric Fever in India and in other Tropical and Sub-Tropical Regions," as follows: "Major Roberts does not regard the native of India as the source of the disease except when in contact with British troops . . ."; inasmuch as in that part of India with which I am personally most acquainted, the native State of Travancore, the opposite may in my experience be said, viz., that the native inhabitants *are* liable to this disease, and that without contact with British troops (of whom there are none in the State) or other Europeans (of whom there are very few).

And in the consideration of this subject I propose, as far as evidences falling under more than one heading will allow, to put my thesis thus:—(I.) That natives of India do suffer from enteric fever, and that without contact with Europeans. (II.) That the attacks are frequently quite typical, as shown (*a*) by their clinical symptoms and progress, (*b*) by bacteriological evidences, and (*c*) by their ability to give rise to typical cases of the disease in Europeans. (III.) But that, in spite of the commonness of sources of infection, many natives appear not to contract the disease, and that this is probably due to an acquired immunity.

## I.—Many Natives in India do Suffer from Enteric Fever.

That *Europeans* in India suffer from this disease is only too well known, whether through the writings of such authorities as Sir Patrick Manson [2], who says: "Typhoid fever . . . is very common among them (young soldiers and civilians) during the first two or three years after their arrival," or by such statistics as the following, collected by E. Roberts [3]: "Enteric fever among European troops in India, 1888-1898, in mean ratios *per mille*: Attack, 23.6; death, 6.29."

It is also very common amongst *Indian-born* Europeans, but with this difference, as compared with temperate climates, that the incidence, according to Rogers' statistics [4], is four times as great among children under 15 and four times as little among adults over 25 years of age; and he further concludes that the explanation of "the comparative rarity among the large adult population of the Indian Army"—0.2 *per mille* only—"is that this remarkably low age incidence also applies to the indigenous population."

This is identical with the theory put forward with regard to enteric fever in Egypt, but strongly opposed by Sandwith [5], who gives the following statistics, which it is interesting to compare with those given above for India, for 1888-1902: "English Army in Egypt, attacks of enteric fever *per mille*, 25.9; Egyptian Army in Egypt, attacks of enteric fever *per mille*, 2.0"; and says: "I have often heard it stated that no adult Egyptian suffers from this disease, and the erroneous theory has been propounded that most Egyptians have suffered from this fever as children, thus procuring an acquired immunity among the adults. I think I may dispose of this theory quite shortly by stating that I have performed, or assisted at, the *post-mortem* examinations made upon several hundred children under the age of 5 years . . . but never in one single case have we ever found pathological evidence of enteric fever, while those cases which I have carefully watched during life, to elucidate this very question, have never displayed clinical symptoms of this disease, nor answered to the serum test."

This same argument from negative *post-mortem* data was formerly used in connection with adult natives of India, as witness Dr. Crombie [6] in 1893: "The native of Calcutta is practically exempt from the disease . . . the argument that cases occur but are not recognized must be very greatly weakened by the paucity of *post-mortem* records of enteric ulceration of the bowels . . . I am not aware that I have ever myself seen a case of enteric fever in a native of Bengal, and my experience includes a period of seven years, when . . . I made not less than 300 *post-mortem* examinations per annum"; but by 1899 positive evidence on the other side was forthcoming, as from A. Buchanan [7], who recorded 25 cases in the Nagpur gaol since 1894, with several *post mortems*, and in 1900 from Surgeon-Major Harris [8], who had "seen cases of typhoid fever amongst natives in Calcutta and other places, and verified the diagnosis in some cases *post mortem*"; while in the same year, according to the Madras Sanitary Report [9], "typhoid fever is an acknowledged factor in the mortality of natives . . . of the Malabar district," and this brings us near to that part of India mentioned in the introduction to this paper—to wit, Travancore.

This is a native State at the southernmost part of the Malabar coast, including, indeed, the very southernmost point, Cape Comorin, about twelve miles from which the Salvation Army has a central hospital, of which I have been for the last eight years in charge, the patients coming from all parts of South Travancore and beyond, and from all classes of native society, the great majority being Hindus.

It is a part of the country untouched by railways, has no British troops, and, outside the capital, hardly any Europeans at all other than a few missionaries of various societies. If, therefore, enteric fever be found, and particularly in the villages, it may safely be considered to be indigenous, and not derived from European sources.

II.—Evidences for the Attacks being truly Enteric.

(*a*) Between January 1, 1901, and March 31, 1908, 45,705 new out-patients attended the hospital, and the general impression left upon my mind is that enteric fever is certainly found among them, more commonly amongst young people, but also in their elders.

Out-patient observations are, however, necessarily incomplete, but I have been able also to find more certain evidence in 17 cases, in natives of India, who during the last three years of the period indicated were admitted to the wards as in-patients, with an undoubted diagnosis of enteric, and omitting some others, doubtful cases, whose records for the sake of accuracy were headed only "? "Enteric."

The ages of these seventeen were as follows: 9, 6, 12, 35, 8, 38, 30, 4, 6, 2, 20, 10, 13, 13, 5, 14, 9—*i.e.*, thirteen (or fully three-fourths) were under 15, one between 15 and 25, and three were over 25.

The clinical signs and symptoms commonly shown by these cases are the following: (i.) Gradual, indefinite onset, commonly with headache. Occasionally in a malarial subject a malarial paroxysm is the first sign of an enteric attack; but vigorous treatment of the malaria will generally allow the enteric course to be thereafter seen. (ii.) Continued high temperature for some days. On this sign Rogers [10] says: "The period of high continued fever is usually quite characteristic, and of great diagnostic value. By 'high continued fever' I mean a temperature keeping persistently above 101° F. . . . and not varying more than 2° F. for at least forty-eight hours." (iii.) Gradual fall of temperature to normal, the total length of pyrexia being three or four weeks. (iv.) Tumidity of abdomen—a valuable sign. (v.) Constipation or diarrhœa. The average Indian is very regular in his habits, usually "going out" at dawn each morning, and sometimes at dusk each evening also. (vi.) A pulse slow relatively to the pyrexia. (vii.) General condition. Some get into a truly "typhoid" condition, but the majority show a less reaction on similar lines. (viii.) Liability to recrudescence or relapse, especially following indiscretions in diet. (ix.) The Diazo reaction.

There are two signs of value in temperate climes which are not usually available in India: (1) The typhoid rash is not distinguishable in the darker-skinned; only occasionally in the comparatively fair skins of the higher castes are faint purplish spots visible. (2) Enlargement of the spleen is commonly not a trustworthy sign, being so frequently met with as a consequence of malaria, unless one happens to know from some examination of the patient shortly before the presumed typhoid attack that there was no previous enlargement of the organ.

*Remarks on Appended Charts of some Cases.*

(*a*) In a girl aged 12: a severe attack of thirty-one days' duration; a "typhoid" condition for some time, but ending in recovery.

(*b*) In a man of 35: showing the typical low pulse-rate.

(*c*) In a man of 38: typical loose stools.

(*d*) In a girl of 13: brought to the hospital in an almost "typhoid" condition, with a history of twenty-five days' fever. At the end of a week the evening temperature had got down to 37° C., and the girl seemed much better, whereupon the parents, frightened at her low diet, took an opportunity to sit her up in bed and administer a good feed of pounded rice—with a resultant recrudescence lasting nineteen days.

(*e*) In a boy of 12: not in the hospital. A mild case, lasting eighteen days only, to a normal evening temperature, but showing a temporary rise on the following day, subsequent to a meal of rice and curry.

The only fatal case among the seventeen in-patient cases was in a girl of 4, who apparently contracted the disease either from her mother or from a great-uncle, whose cases are mentioned later in connection with one method of transmission of the disease.

Being far away from any bacteriological laboratory, we have hitherto not been able to confirm these clinical evidences by the serum test, but since 1901 there has been abundant proof forthcoming in other parts of India that the application of this means and diagnosis gives positive results. In that year R. H. Elliot [11] verified thirteen cases by it among natives in the General Hospital, Madras, and in the following year Leonard Rogers [12] published the conclusion to which he had come, that "So far are natives removed from being immune to enteric that the disease is really quite common among them, a continuous series of cases having been recognized by means of the serum test during the last five months in the Medical College Hospital, Calcutta"; while in 1908 the last-named writer says: "During the last few years I have repeatedly obtained positive serum tests for typhoid in high dilutions of 1 in 100 or more"; so that I have no doubt but that when we have facilities for carrying out similar observations in Travancore, like results will be obtainable.

It is generally accepted that these infectious diseases "breed true," and therefore that any undoubted case implies a previous one as the source of infection.

Now, in Europeans the diagnosis of a marked case is usually far less open to doubt than in an Indian, and I therefore propose to mention here a series of cases in which it seems certain that the infection came from native sources, with the resultant deduction that the natives of India do indeed suffer from true enteric fever.

About 1902 I was asked to attend some sick inmates of a Roman Catholic convent, about eighteen miles away, and found that while one case was malarial, the other two patients were typically enteric, of whom, indeed, one died. Now, this convent, which also includes within its walls an

orphanage for native girls, is situated in a village entirely native, with which there is daily communication through older women, who do work in their homes which they have learnt in earlier years from the nuns, and come to the convent in connection therewith. The patients in question had not been away from their community; whence, then, did they become infected but from some "native" case?

In 1904 one of the European officers in charge of the Salvation Army work in his district was living in a village containing no other European inhabitant, with a native boy to attend him and prepare his meals after the Indian fashion. I saw him on September 1, when he complained of headache for three or four days—attributed to exposure to the sun—and some feeling of faintness and malaise; there was nothing to cast doubts on the ætiology suggested, and he returned to the village, no further news coming till the 7th, when his temperature the previous evening was said to have been 40.1° C.! He was brought in to a room in my quarters on the following day, when a plentiful rose rash was evident, and passed through a severe attack of enteric, the evening temperature remaining at about 40° C. till September 26, and once reaching 41.2° C.

Again, in 1906 the Rev. Father C. was in charge of a native congregation off the main road to Trevandrum, and lived in some rooms adjoining his church, attended by a native servant. I was called to him when he had been ill about a week, had him removed to a place somewhat more accessible, and there he successfully came through a fairly severe attack of enteric (unfortunately only to die about a year later from cholera).

Whence did these two Europeans become infected with the specific bacillus but from some "native" source of infection in their respective surroundings?

The last case I have to mention under this heading is an even more striking one:—

I had been attending in his own home in a caste village (the first European visitor thereto, I believe, in its history), about three miles from the hospital, the heir of a well-to-do Hindu family, with a serious attack of what I considered to be enteric fever, and the patient had recovered to the very great joy and satisfaction of his family, who presently desired to show their gratitude by inviting as many as possible of the hospital staff to a feast after their own manner, at which they might present a thankoffering, an invitation which was accepted. We never hesitate to take food freshly cooked in accordance with caste rules, and served after the Indian custom straight from the cooking vessels to a fresh plantain-leaf, as, in the absence of flies, such food may be considered practically sterile, while the fresh leaf is much safer than a plate or dish washed in water from a doubtful source, and wiped on a cloth by no means necessarily free from infection (*e.g.*, last year a high Government official and some of his family died from cholera, the infection of which was traced to the cloths used for wiping the plates, &c., the tablecloth having been washed at a pool to which cholera-infected garments had just previously been taken!).

There are also three safe beverages in an Indian village, in order of safety: (1) Tender cocoanut water (absolutely safe); (2) fresh conjee-water—*i.e.*, the water in which the rice has been boiled—if no other water be added afterwards; (3) coffee, which is always boiled, as is the milk, but may be infected through the sugar.

On this occasion the first named was provided; but towards the end of the meal one of the hospital staff, a Swede, aged 27, asking for a little more, was by accident given some of the ordinary drinking water of the house, of which he took a drink before discovering the mistake; the rest of the party drank only tender cocoanut water.

Twelve days later an attack of enteric fever of moderate severity manifested itself in the victim of this mischance—a result which, I suggest, incidentally confirmed the diagnosis of the original case in that house.

### III.—Have many Natives an Acquired Immunity?

In some interesting remarks last year by Lieut.-Colonel D. B. Spencer [13], he quotes the statistics for the British and native troops in India for fifteen years ending December 31, 1906, showing 21,929 cases, with 5,481 deaths, among the British (not counting officers), and only 808 cases, with 223 deaths, among about twice the total strength of natives; and expresses the opinion that while, "if the difference in figures of the incidence of typhoid in the British and native communities were slight, one might possibly admit a relative immunity among native troops, the result of their having lived for generations amidst insanitary surroundings in their village homes previous to enlistment in the Army," the actual difference is *too great* to be thus accounted for, it may be "that the excessive consumption of animal diet by European troops in India, in a climate where such food is generally unsuited, may possibly explain the relative frequency of enteric fever among European troops, as compared to the same disease among native troops, both living and working side by side in our military cantonments, year in year out, under precisely the same hygienic conditions."

This is followed up by Major Thompson [14], who suggests that the enteric germ "cannot gain a foothold in those not already predisposed to nurture it by 'the prepared ground' of an irritated intestinal canal superinduced by 'luxus consumption of proteids.'"

That Europeans in India are apt to consume an excessive amount of animal food, and that it is a climate where such food in excess is generally unsuited, is pretty generally admitted, but that this habit, while unwise, is apt to set up "an irritated intestinal canal," is more open to question, and I do not quite see why it should necessarily be easier to account for *so large* a difference (Colonel Spencer does not see any difficulty if the difference were

but *slight*) by a (supposititious) condition of the intestines in the Europeans concerned, who are also liable to the disease in their own land, than by a condition of acquired immunity in the natives of the country, where they are certainly liable to conditions favouring infection, yet in many cases without becoming infected.

In support of this theory, it is stated that the Ghurkahs are more nearly akin to Europeans in their meat-eating and other habits, and that the Ghurkah troops are also intermediate between the other native troops and the British in their liability to contract enteric.

There, however, seems to me to be a fallacy underlying these wide statements of diet, in that it seems to be implied that the natives of India are all practically vegetarian, which, in South India at least, is certainly far from being the case in civil life, where only the Brahmins and the élite of the upper castes are vegetarians from principle and the very poor from their poverty.

Curious to relate, too, out of ten cases of typhoid fever in the persons of natives in India, reported by G. Lamb [15] in 1902, six out of the ten were in Brahmins!

I would suggest that some instructive statistics might be compiled by those who have the opportunity, if the entire figures were worked out for different classes of Indians in the same regiments or cantonments; for instance, in one there may be Mohammedans, who are flesh-eaters, and Brahmins, who are strict vegetarians. One ought, according to the diet theory, to find a very marked disproportion between the incidence on the two classes of otherwise almost identical environment and habits.

If, then, it may be accepted that some natives of India do suffer from enteric, it only remains to consider their habits and surroundings in relation to hygiene to arrive at the conclusion that the means of infection must be almost universal in the country, and so to come to the question: "Why do they not *all* contract it?"

Some observers, indeed, have swung from the early belief that Indians are not liable to disease at all to the opposite extreme, as in the "Remarks on the Apparent Immunity of Asiatics from Enteric Fever," by F. W. Clarke [16], in which he quotes from his own report for 1897: "It is interesting to note the small number of cases of enteric fever which occurred among the Chinese during the year (in Hong Kong), an experience which accords with the apparent immunity of the native population of India from this cause, while the circumstances connected with these cases appear to suggest that the same explanation of the apparent immunity may apply to both races—viz., that they are so fully exposed to the infection throughout the whole period of their existence that they almost always contract the disease in infancy or early childhood, when, if they recover, the disease will have been practically unnoticed"—(Whatever may be the case with the Chinese, according to Dr. Clarke, my own fairly close acquaintanceship with Indians of widely different grades does not incline me to accept for a moment that many parents, except possibly of the most aboriginal and backward classes, are to be found so utterly lacking in observation and in care for their children as this would seem to imply.—P. E. T.)—"while, if they succumb, the death will be attributed to diarrhœa, convulsions, or some other symptom"; which may be compared with the statement attributed by Dr. Andrew Duncan [17] to Elliot of Madras that "all natives suffer from it at some time or other."

Sometimes indeed the infection does seem to be particularly virulent, and a number of people together or in quick succession contract the disease, as in the following instance:—

In January, 1907, a Sudra woman, aged 30, was admitted on the sixth day of an attack, but stayed in hospital six days only, and then was removed back to her village. She was a member of a large Hindu joint family, and a little later there were the following additional cases in the house: Uncle, about 60, and three children, boys of 8 and 6 and a girl of 4. As the house was a particularly spacious one, at the family's urgent request I sent out one of my senior students for a few days to take charge of the elder patient, with the result that in about a fortnight he also was attacked, in spite of great care in the matter of antiseptics, drinking water, &c. I attribute this unusual number of cases in one house to two factors: (1) The attacks were accompanied by diarrhœa; (2) the place simply swarmed with flies, from which it was almost impossible to keep food free even while it was being eaten.

During the times when flies are prevalent they must be a very powerful means of infection, as is the case with cholera, which is seldom absent from us in the dry season, although varying considerably in extent from year to year. Generally speaking, it starts towards the end of the year with a few sporadic cases, but, unless some big festival intervenes, not to an epidemic extent until some fishing village on the coast is affected. In these fishing villages large quantities of fish are sun-dried, and the plague of flies about them is great in consequence; apparently, when a case of cholera appears in such a place, the half-dried fish is quickly infected by means of the flies, and then one hears of a sudden outbreak of cases in the inland parts to which the fish has been taken.

But generally speaking, although there may be one or more distinct foci of enteric infection present in a community, there is no epidemic of cases.

Take, for instance, the orphanage in the same compound as the nunnery referred to above; most of the orphans had been taken in as babies and lived there all their lives, but there was no epidemic among them, although two of the European nuns had somehow contracted the disease in spite of sanitary habits very different to those of Indian children or adults either.

Then, again, my European assistant was apparently infected by a single drink of the water habitually used by all members of that Sudra

household, rather a large one, including three generations, and well known to me, so that I can be practically certain that no other case of the disease occurred among them and that the younger ones at least had not suffered similarly at an earlier date.

Yet consider the native habits with regard only to water. The orthodox Hindu must bathe every morning. If there be a river near he will probably go thither, but usually he must be content with a neighbouring "tank" (a more or less artificial lake or reservoir) in which he will bathe himself, wash his clothes, and then *rinse his mouth*. To the same water, when tired of walking, he will come to bathe his feet, to it the herdman brings his buffaloes and oxen, to it the dhobi brings his bundles of soiled clothes for washing. But none of these uses will be considered to make the fluid unfit for use in the daily careful toilet of the teeth. The said teeth generally do the care bestowed upon them great credit, but what of the digestive tract at the same time inoculated with innumerable bacteria?

Next, consider the "jungle," the pieces of waste land to which the whole population resorts each morning for the offices of Nature, the dejecta being left upon the surface of the ground to the drying of the sun and the wonderful operation of the white ants, by which a definite fæcal mass can hardly be recognized as such in perhaps twenty-four hours, and can easily therefore be carried on the feet of some other comer in the next day or two to the tank at the time of the morning bath, apart from being blown about as dust by the wind after desiccation under a tropical sun.

It may, perhaps, be questioned: (*a*) Are *infected* people likely to go out to the "jungle"? (*b*) Would not any parasitic bacteria soon be destroyed by the further action of that tropical sun?

In answer to (*a*) may be mentioned, firstly, the now generally accepted existence of "typhoid carriers," who, having recovered from an attack of the disease, continue for a long time intermittently to discharge virulent bacteria from the bowel; and, secondly, the following specific instance of another character, reported by T. P. Woodhouse [18]: "Four orderlies, who had been employed exclusively in nursing enteric fever cases . . . were all in perfect health: none had been inoculated nor had had enteric fever. They lived together in a separate tent. On examination, two out of the four were found to be enteric bacillus carriers; in both the fæces were infectious." Woodhouse asks: "Why did not the two infected men convey the disease to their comrades who had lived for some months in such close relations to them?" and suggests in answer that either they were immune or that the bacillus of these chronic carriers is not of an active, highly-infective character.

The latter hypothesis hardly seems to be tenable when one remembers that these bacilli had presumably been caught from the actively infectious cases which these orderlies had been nursing: while it may be further queried, "Why did not the carriers themselves get enteric fever?" to which I would suggest the answer, "Because they both had acquired an active immunity."

In connection with question (*b*), the experiments in Kasauli of W. S. and L. W. Harrison [19] are of great importance: "Contaminated dust was exposed to the sun daily in June from 10 a.m. to 4 p.m., the test thermometer giving an average temperature of 53° C.; yet living typhoid bacilli were recovered after seventy-seven and a half hours, during twenty-three hours of which the direct rays of the sun had been acting."

It would appear, therefore, that in spite of the exposure to a tropical sun typhoid bacilli may survive in infected dejecta for several days at least.

Lastly, how often, remembering Horton-Smith's discovery of the *Bacillus typhosus* in urine, may not the very vicinity of the houses be specifically contaminated by the prevalent habit of micturition there during the dark hours by nearly everybody, including even the sick, when anyhow possible?

I am led to the conclusion, therefore, that in South India we may well suppose that "widespread prevalence of the virus . . . or possibly of the virus of other allied filth diseases," which Roberts [20] postulated as a necessary precedent condition for the production of *acquired personal immunity* through "the constant ingestion or imbibition of doses of the virus which do not avail to induce an attack," and that this form of acquired immunity is the great reason why the native population has not to be divided up—to make an adaptation of the old pre-vaccination era variola census classification—into (1) Those who have previously had enteric; (2) those who have just had enteric; (3) "those who have to have their" enteric!

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[8] HARRIS. *Indian Medical Gazette*, 1900, p. 54.
[9] Review in *Indian Medical Gazette*, 1900, p. 453.
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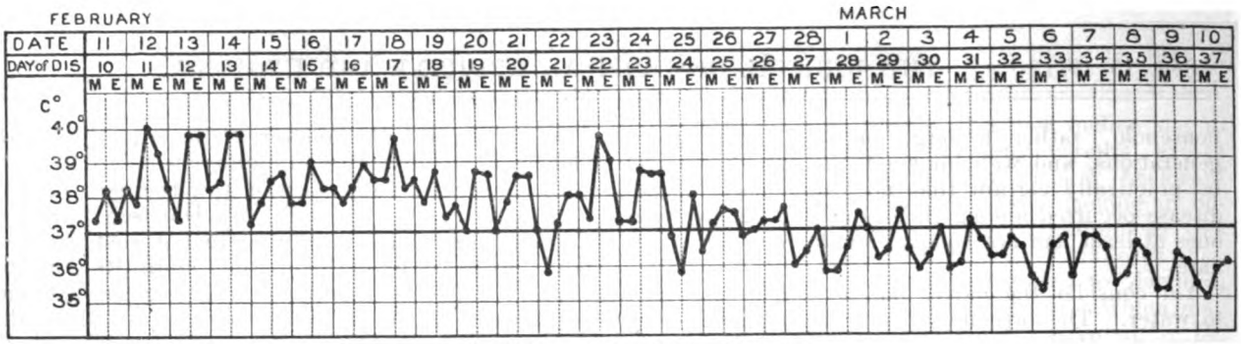
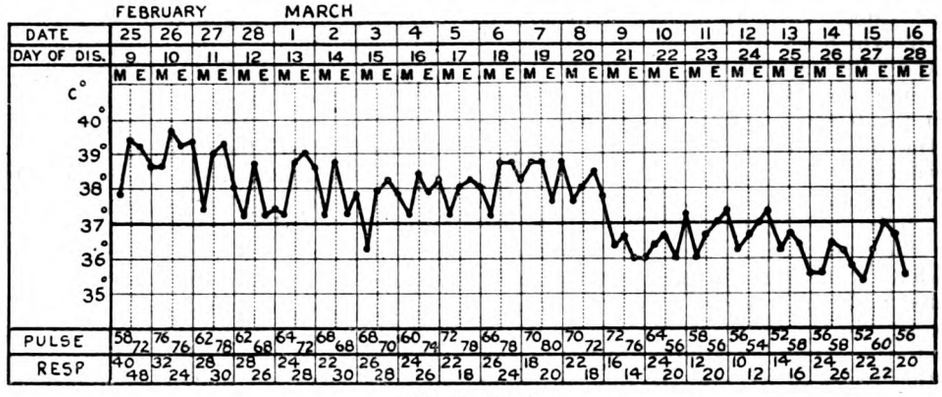
[12] ROGERS. *Indian Medical Gazette*, 1902, p. 12.
[13] SPENCER. *Indian Medical Gazette*, 1908, p. 297.
[14] THOMPSON. *Indian Medical Gazette*, 1908, p. 298.
[15] LAMB. *Indian Medical Gazette*, 1902, p. 148.
[16] CLARK. *British Medical Journal*, 1901, p. 211.
[17] DUNCAN. *British Medical Journal*, 1901, p. 692.
[18] WOODHOUSE. *Journal of the Royal Army Medical Corps*, 1908, p. 618.
[19] HARRISON. *Journal of the Royal Army Medical Corps*, 1904, p. 722.
[20] ROBERTS. *Op. cit.*, p. 377.


## POSTSCRIPT, APRIL, 1911.

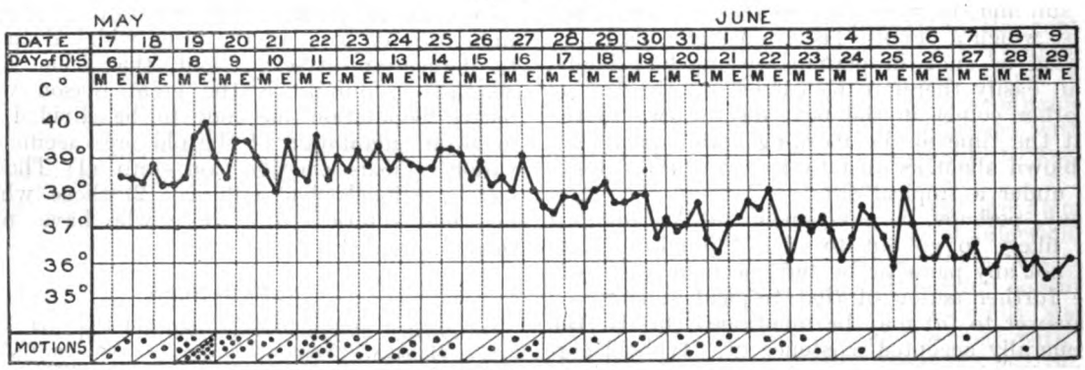
To bring the statistics given in the foregoing paper up to date, I am now able to add the numbers and age-classes of those admitted to the Hospital for enteric during a second period of three years, viz., up to March 31, of this year.



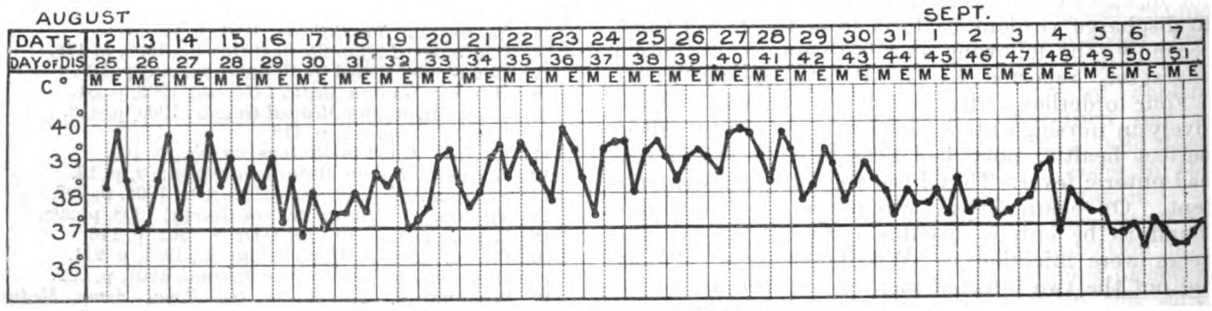

(*a.*)—Thirty-one days fever. Recovery.



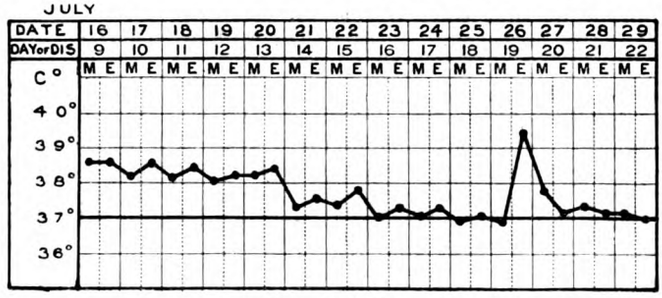

(*b.*)—Low pulse.




(*c.*)—A typical case.




(*d*)—Recrudescence after 30th day.




(*e.*)—A mild case.

ENTERIC CHARTS. (*See page* 270.)

It will be seen that the total number of admissions is very much greater than in the previous period, but this will in part have been accounted for by recent additions to the hospital buildings, more than doubling the previous accommodation for in-patients.

Ages: 16, 16, 42, 2, 1, 17, 36, 28, 57, 9, 16, 9, 20, 3, 20, 4, 8, 4, 10, 20, 10, 12, 1½, 30, 35, 30, 18, 5, 6, 27, 14, 8, 12, 35, 11, 12, 30, 19, 31, 26, 31, 5. Of these, twenty, or almost half, fall into the under 15 category, nine are between 15 and 25, and thirteen, or not quite one-third, are over 25 years of age, giving an average of 17.7 years of age, compared with one of 13.7 in the cases admitted during the first period examined.

## TRANSMISSION OF AMAKEBE BY MEANS OF *RHIPICEPHALUS APPENDICULATUS*, THE BROWN TICK.

By Dr. A. THEILER, C.M.G., Pretoria.

(Communicated by Colonel Sir D. Bruce, C.B., F.R.S. Received April 20,—Read before the Royal Society, May 18, 1911.)

THAT the disease in calves of Uganda called amakebe is identical with East Coast fever had to be concluded after the presence of the so-called blue bodies of Koch, or plasma bodies, had been demonstrated in the internal organs; these bodies represent certain stages, agametes, agamonts, and gamonts, in the life-cycle of *Theileria parva*. Accordingly, it had to be expected that amakebe could be transmitted by means of such ticks, which act as hosts for this parasite. The most common tick of Uganda is the brown tick, *Rhipicephalus appendiculatus*, which has been proved in South Africa to be the principal transmitter of East Coast fever.

When in Uganda in 1909 an arrangement was made between Mr. Hutchins, the Government Veterinary Surgeon of Uganda, and myself, to place adult brown ticks, collected as nymphæ from calves suffering from amakebe, on susceptible calves in my laboratory in Onderstepoort, Pretoria, Transvaal; these ticks were to be collected by Mr. Hutchins as opportunity occurred.

On several occasions Mr. Hutchins forwarded me brown ticks, which he had placed in a glass tube; in every instance they arrived alive and in good condition, having moulted in transit from the nymphal into the adult stage. The first two lots of ticks failed to transmit the disease, the nymphæ probably having been collected off calves which had recovered from the disease, when the blood no longer contained the pathogenic parasite. Experiments with the last lot were successful, as will be shown hereunder.

### EXPERIMENT TO NOTE WHETHER BROWN TICKS COLLECTED AS NYMPHÆ IN UGANDA FROM A CALF SUFFERING FROM AMAKEBE WILL TRANSMIT THE DISEASE TO SUSCEPTIBLE CALVES IN THE TRANSVAAL.

(1) *Bull calf* 1118, born and reared in Onderstepoort, was infested on January 23, 1911, with ten adult brown ticks, forwarded by Mr. Hutchins from Uganda and received here on January 4, 1911. All ten ticks were found attached to the calf the following day.

The calf showed almost immediately a rise of temperature, developing into a definite curve, during which the so-called marginal points (*Anaplasma marginale*) were noted to be present in great numbers; this curve was typical of the disease anaplasmosis, and the blood lesions found were those of an oligocythæmia (anisocytosis, poikilocytosis, polychromasia, and basophilia) which followed as a sequel. The temperature gradually dropped, and the calf was found dead on the twenty-second day after tick infestation. An examination of the lymphatic glands was made on the seventeenth day, and a negative result was registered.

*Post-mortem Examination on Calf* 1118.—The condition was fair. Rigor mortis was present. Tympanitis was noted. The lungs were partially collapsed, and showed some atelectatic areas. On section a slight œdema became noticeable; in the trachea was some foam. The bronchial lymphatic glands were swollen, the mediastinal glands were normal.

The pericardium contained some clear liquid. The blood in the ventricles was well coagulated. Both endocardia were normal. The liver was enlarged, and had a mottled appearance due to small pale areas; the parenchyma was soft. The periportal lymphatic glands were enlarged. The bile was yellow and viscid. The spleen was enlarged, measured 30 cm. by 10 cm., the pulp was softened, jamlike; the trabeculæ were indistinct. All four stomachs were normal.

The mucosa of the jejunum was slightly thickened and œdematous, that of the cæcum and colon was slate-coloured and contained a small number of disseminated parasitic nodules.

The kidneys were pale, the capsule was easily detachable, and the urine was clear. The exterior lymphatic glands were swollen.

The microscopical examination of the blood proved the absence of any parasites. In the lymphatic glands the so-called plasma bodies of Koch were found and described as rather small—viz., agametes and young agamonts (according to Gonder *); the same observation was made in preparations of the spleen.

*Diagnosis.*—East Coast fever.

(2) *Calf* 1143.—On February 14, 1911, this calf was infested with ten adult brown ticks of the same lot obtained from Uganda. On February 15 seven of these ticks were found attached. After an incubation time of thirteen days a typical fever curve ensued, which, however, never reached high records. The animal died on the twenty-fourth day.

On the fifteenth day after the tick infestation both blood and glands were examined, and the result was negative. The examination on the seventeenth day revealed rare agamonts in the prescapular glands, but no parasites in the blood; on the twentieth day both agamonts and gamonts were found in the lymphatic

* "Annual Report of the Government Veterinary Bacteriologist, Transvaal, S.A.," 1909-10.

glands in a fair number, and *T. parva* was frequently met with in the red corpuscles.

*Post-mortem Examination of Calf* 1143.—Rigor mortis was present. The condition was rather poor. All external lymphatic glands were very much swollen. The lungs had not collapsed; there were some patches of red hepatisation in right anterior lobe and a small area in the left lobe. The lesions of hyperæmia and œdema were pronounced. There was a fibrinous coagulum in the trachea.

The bronchial and mediastinal lymphatic glands were enlarged and œdematous. The heart contained coagulated blood. Both endocardia and the myocardium were normal. The liver was enlarged, the margins were rounded, the colour was reddish brown, the parenchyma was rather soft. The bile was green, thick, and viscid.

The spleen measured 30 cm. by 9 cm.; the pulp was soft and jamlike, and the trabeculæ were indistinct. The mucosa of the fourth stomach was slate-coloured; there were a few small hæmorrhagic ulcers. The mucosa of the jejunum showed longitudinal slate-coloured streaks. The mucosa of the ileum was slightly thickened, and dotted with punctiform hæmorrhages. The mucosa of the cæcum was thickened, the blood-vessels were injected, and there were patches of hyperæmia. The mucosa of the colon was slightly swollen and slate-coloured. The mesenteric glands were much enlarged and rather soft. The kidneys were rather pale; the boundary zone of the right kidney was slightly hyperæmic; the capsule was easily detachable. The bladder contained clear, yellow urine.

*Microscopical Examination.*—Koch's granules were found frequently in the lymphatic glands and spleen.

*Diagnosis.*—East Coast fever.

The infestation of two calves with adult brown ticks collected as nymphæ in Uganda from a calf suffering from acute amakebe, was succeeded in both instances by a fatal disease, which could be diagnosed as East Coast fever from the appearance of the so-called Koch's blue bodies or plasma granules, which represent, according to Gonder, the agametes, agamonts, and gamonts in the life-cycle of *T. parva*. The *post-mortem* examination corresponds with amakebe of Uganda, and with what is known as East Coast fever. The fact that the blood of the first calf did not show blood parasites is nothing unusual in amakebe. The agamonts were there, no gamonts had yet developed, accordingly no gametes of *T. parva* could be found. This calf apparently died at the beginning of the disease, the animal being weakened by the preceding *anaplasma* inoculation. The second calf represented in every respect a typical case of East Coast fever.

### Conclusion.

Amakebe of Uganda is identical with East Coast fever of South Africa, and is transmitted by the tick *R. appendiculatus*. This conclusion corroborates that obtained by the Royal Society Sleeping Sickness Commission of 1909.

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## BLACKWATER FEVER.

By Lawrence G. Fink, M.B., C.M.Edin.
*Civil Surgeon, Myaungmya, Burma.*

In the *Lancet*, June 10, 1911, pp. 1591-2, reference is made to an interesting clinical account of a case of blackwater fever in the Eastern Transvaal. Dr. J. Stanley Avery, who reports the case, states that the patient had contracted malarial fever in November, 1909, and had suffered from relapses during the year following. In November, 1910, he fell ill with general malaise, headache, anæmia, nausea and bilious vomiting, and early in December hæmoglobin appeared in the urine. No malarial parasites were detected in blood films, two of which were examined at intervals of a fortnight. Quinine was purposely withheld during the first three weeks on account of the absence of malarial parasites in the blood films, and of the presence of blood (?) in the urine. It was then administered as bi-hydrochloride, in gradually increasing doses, until as much as 30 gr. daily were given, without favourably influencing the course of the fever. Dr. Avery does not believe that blackwater fever can be due to malaria, for the doses of quinine that are sufficient to influence favourably such cases were of no material benefit in the case reported. Neither does quinine appear to him to have been a possible cause in the present instance, for hæmoglobinuria did not occur until ten days after all quinine had been stopped. He thinks, however, that quinine may cause exacerbation of symptoms if persisted in for some length of time, blood or some hæmoglobin derivative being excreted in the urine. Dr. Avery inclines to the view that blackwater fever is a separate entity.

The first conclusion arrived at by Dr. Avery appears to me to be erroneous, but, as the theory of the non-malarial origin of blackwater fever is still maintained by certain eminent authorities, the subject requires careful consideration. In an editorial in the *Therapeutic Gazette*, May 15, 1911, reference is made to a very valuable paper in the January issue of the *Archives of Internal Medicine*, by Dr. Charles F. Craig, who expresses his very strong belief that hæmoglobinuria is practically never due to malarial infection, and also practically never due to the administration of quinine for the cure of malarial infection. He further says that although it is true hæmoglobinuric fever only occurs in regions where malarial infections are prevalent, this by no means proves that such attacks are of malarial origin. Thus he points out that hæmoglobinuric fever is very prevalent and widespread in Africa, common in Sicily and Sardinia, but rarely occurs in Italy. In India, he says, hæmoglobinuric fever occurs in very limited localties, although a large part of the country is intensely infected with malaria. So, too, in Trinidad, where malarial infection is severe, blackwater fever is almost unknown, unless it occurs in imported cases. Some of the worst malarial portions of Italy have never seen a case of hæmoglobinuric fever, and the same is true of the Straits Settlements, the Islands of

Polynesia and the countries of South America, as well as of the Philippines. Craig thinks that even when hæmoglobinuric fever exists side by side with malarial infection, the condition is probably due to an associated infection, and not to the presence of the malarial parasite. Concerning the relationship between quinine and hæmoglobinuric fever, he produces strong evidence that in those cases in which quinine has been given and hæmoglobinuria has developed, it has been a coincidence, not cause and effect. If quinine was really the cause of hæmoglobinuria in malaria, it ought certainly to produce this condition in a larger percentage of case than it has done. Finally he asserts that the symptomatology and pathology of hæmoglobinuric fever are distinctive and unlike any form of fever with which we are acquainted.

Before discussing the conclusions arrived at by the above-quoted writers, it is necessary to keep certain facts clearly in mind, and thus to avoid unnecessary confusion of ideas. Amongst those who support the theory of the malarial origin of blackwater fever there are two distinct sets. Christophers and Bentley, in their address at the Bombay Medical Congress, 1909, on the "Intimate Pathology of Malaria in Relation to Blackwater Fever," have pointed out how blackwater fever may be malarial in origin and yet not be malaria (*i.e.*, an attack of malaria). They say that to prevent misconception regarding the relationship between the two conditions, it is necessary to disabuse our minds entirely of the idea that in an attack of blackwater fever we see anything of the nature of a malarial paroxysm. According to them: "Blackwater fever is a new condition, the outcome of malarial intoxication under certain circumstances." Hence it is that the symptomatology of blackwater fever and malaria differ to some extent. As regards fever, for instance, the temperature chart in a case of the former condition differs from that of a case of malaria. The cause of the temperature, when hæmoglobinuria occurs, has not yet been ascertained, is, according to Ross, not due to the presence of malaria parasites in the blood, and quinine does not cause it to disappear as in a pure malarial attack. This disposes of Dr. Avery's arguments against the malarial origin of blackwater fever. Major Ronald Ross, from his recent enumerative studies on malaria, considers that no fever is produced unless the parasites exceed a given limit, say from 500—1,500 cm., and that there is a close correlation between the number of parasites and the amount of fever caused by them. In a pure malarial attack the temperature will be reduced to normal by quinine when the "pyrogenic limit" has been reached, *i.e.*, when the parasites have been reduced to 500—1,500 per cm. In blackwater fever, when hæmoglobinuria occurs, parasites are scarce or absent, and quinine has no effect in reducing the temperature, which is due to some other unascertained cause. Deaderick says the fact that hæmoglobinuric fever does not respond to quinine is one of the strongest evidences that it is not an attack of malaria *per se*. According to this author, etiologically hæmoglobinuric fever stands in the same relation to malaria as do tabes and dementia paralytica, and may, very properly, be regarded as a "para-malarial" infection. Dr. A. G. Newell, on the other hand, regards blackwater fever as a bilious malignant tertian ague. He considers that it is a malignant tertian fever with a superadded congestion of the liver which prevents that organ from dealing with the hæmoglobin, which is then excreted by the kidneys. In his opinion, in the malignant tertian affections hæmoglobin frequently passes out into the urine in small quantities not sufficient to call the case blackwater fever, and also that it is extremely difficult in some cases of malignant tertian malaria to know where malignant tertian ends and blackwater fever begins. It is true that parasites have been found prior to the occurrence of hæmoglobinuria, but it is not correct, as stated by him, that in marked cases of blackwater fever the temperature chart is that of a malignant tertian affection. Periodicity is not a conspicuous feature, nor is the characteristic curve of Marchiafava and Bignami seen. The temperature of hæmoglobinuric fever may be intermittent, remittent or irregular, and may resemble the curve of septic fever. According to Deaderick, cases in which the temperature is normal or subnormal throughout are not unknown. Furthermore, quinine has no effect in reducing the temperature of blackwater fever as in a pure malarial attack. The occurrence of post-hæmoglobinuric fever with absence of parasites in the peripheral blood and uninfluenced by quinine may be urged as pointing to a difference between these two conditions. It has, however, to be borne in mind, as stated by Deaderick, that a post-malarial secondary fever, or spodogenous fever, is occasionally observed after the infection, particularly æstivo-autumnal, has lasted for some time. It persists for days or weeks uninfluenced by quinine. The blood examination is negative for parasites. Reabsorption of débris, toxins, and visceral lesions have been offered as explanations of this process, but none of these, according to the author, are entirely satisfactory. Post-hæmoglobinuric fever is said by Deaderick to be probably related to post-malarial secondary fever.

In considering a case of blackwater fever there are three stages to be definitely recognized:—

(1) The stage which resembles an ordinary attack of malaria. There is fever, parasites are usually found in the blood, but there is no hæmoglobinuria.

(2) The stage in which there is fever, usually no parasites, but hæmoglobinuria occurs.

(3) The post-hæmoglobinuric stage, when the urine has cleared up, fever resembling post-malarial secondary fever may occur and parasites are usually absent from the peripheral blood. This stage may be repeated.

Quinine has no effect on the fever in the latter two stages. These three stages or periods are exem-

plified in a case recently reported by Major Ronald Ross in the *Transactions of the Society of Tropical Medicine and Hygiene*, March, 1911, pp. 144-6. He says that during the second and third periods the parasites were too scarce to cause the high degree of fever observed. What, then, he asks, was the cause of the fever during these periods? It could not have been the hæmoglobinuria, because this was entirely absent during the third period. From a consideration of these facts, he concludes that in blackwater fever there must be some subterranean factor at work, some process different from the ordinary process of ordinary malaria.

Major Ross draws attention to the recent investigations made by Dr. G. C. L. Simpson (*Annals of Tropical Medicine*, volume iv., No. 3), who found that in ordinary malaria the hæmoglobin escapes, not by the urine, but by the liver and the fæces, as estimated by the amount of urobilin in the latter. When the hæmoglobin discharge is excessive some of it also escapes as an overflow by the kidneys, thus producing blackwater. In Major Ross's case above alluded to, the vast bulk of the hæmoglobin during the second period escaped by the fæces, and only a small proportion by the urine. During the third period the fæces do not appear to have been examined, but Major Ross thinks that the hæmoglobin was apparently not enough to require any overflow by the kidneys, so that no hæmoglobinuria appeared. These investigations throw a new light on the blackwater fever process, and help to strengthen one's belief in the theory of the malarial origin of the disease. It may, however, be urged that an associated parasite may similarly cause hæmoglobinuria, but the fact that blackwater fever unimported has not been known to occur in any area free of malaria points strongly to malaria as the essential cause of the disease. In a paper on "Blackwater Fever in Burma," which is being sent to be read at the Second Biennial Congress of the Far Eastern Association of Tropical Medicine, I have drawn attention to certain etiological considerations, and have urged the importance of the "human factor," which, as pointed out by Christophers and Bentley, probably was the main cause of the permanent exaltation of malaria in the Duars. In Burma the disease has been known to occur only in certain very malarious areas, and has affected chiefly Europeans and Indians who have been exposed to malarial infections, and have been unprotected by immunity to malaria. The natives of these areas very rarely suffer from the disease. According to Deaderick the accession of Europeans was influential in the history of blackwater fever in several ways—by the increase of susceptible population, by the importation of quinine and by the advent of physicians competent to recognize and to describe the disease. In Burma the rapid development of the resources of the province, rich in minerals, timber, paddy, rubber, and other agricultural products—has led to the increase of the susceptible population, Indian, Chinese and Europeans. In some of the frontier stations on the Chinese border, there are large battalions of Indian sepoys who suffer a great deal from malarial fever, and amongst these blackwater fever has occurred. In the Myitkyina district the first case was recognized by me in 1899 and a few cases have subsequently been met with in this and adjacent districts. Details of some of these cases have been given in the paper above referred to. Information is being collected as to the prevalence or otherwise of the disease in other parts of the province where malarial infection is severe. I am much inclined to think that careful investigation will reveal that in highly malarial areas, given a susceptible population, unprotected by prophylactic measures, exposed to unfavourable climatic conditions and employed on fatiguing works, cases of hæmoglobinuric fever will be found to occur more frequently than has hitherto been reported. In India, Craig says, hæmoglobinuric fever occurs in very limited localities, although a large part of the country is intensely infected with malaria. Statements such as these, unsupported by detailed evidence, are very misleading. Major James, at the Imperial Malaria Conference, Simla, 1909, stated that it is, or was until quite recently, a common belief that Assam as a whole is intensely malarious, but the truth is that a great part of the country is only very slightly malarious, and in some areas the disease does not occur. He adds that the same may be true even of a country with so bad a reputation for malaria as Burma. In the light of Dr. Simpson's investigations, cases of malignant malaria should be carefully studied with reference to the amount of hæmoglobin excreted in the fæces. In some of these cases it may be found that a stage arrives when some overflow takes place through the kidneys, the temperature becomes irregular and quinine no longer has any beneficial effect. These cases might easily be overlooked.

The theory that blackwater fever is a "para-malarial" disease has as much in its favour as that of tabes being a "para-syphilitic" disease. According to Ferrier, tabes occurs in only 1.5 per cent. of all persons who contract syphilis. The incidence of blackwater fever is no doubt very small as compared with the total number of malaria infected persons, but not sufficient *per se* to exclude it from the possibility of being a para-malarial complication. Fournier has conclusively proved that mercury *judiciously* administered in the early stages considerably lessens the incidence of para-syphilitic affections, such as tabes and general paralysis of the insane. Similarly, quinine *judiciously* administered will reduce the incidence of blackwater fever. Koch has stated that if a man had blackwater fever and after the attack was over took small doses of quinine and then full prophylactic doses, he would never contract either malaria or blackwater fever again. Dr. Harford (*Transactions of the Society of Tropical Medicine and Hygiene*, June, 1911, p. 200), considers that Koch may have overstated the case, but the German statistics go to show that quinine

is just as likely to prevent blackwater fever as malaria. There is still much difference of opinion as to the best method of administering mercury for syphilis and quinine for malaria. As regards the latter, readers are referred to the following very instructive and interesting recent publications:—

(1) "Problems Relating to the Use of Quinine," by Major S. P. James, I.M.S., *Proceedings of the Imperial Medical Conference*, Simla, 1909.

(2) "Scientific Memoirs," No. 41. "Quinine and its Salt; their Solubility and Absorbability," by Captain MacGilchrist, I.M.S.

(3) "The Present Position of Quinine Prophylaxis of Malaria," by Dr. W. Carnegie Brown, *Transactions of the Society of Tropical Medicine and Hygiene*, June, 1911.

Sir David Ferrier strongly favours the view that still more thorough and effective treatment of syphilis might prevent the development of tabes altogether. The same may be said of the prophylactic treatment of blackwater fever.

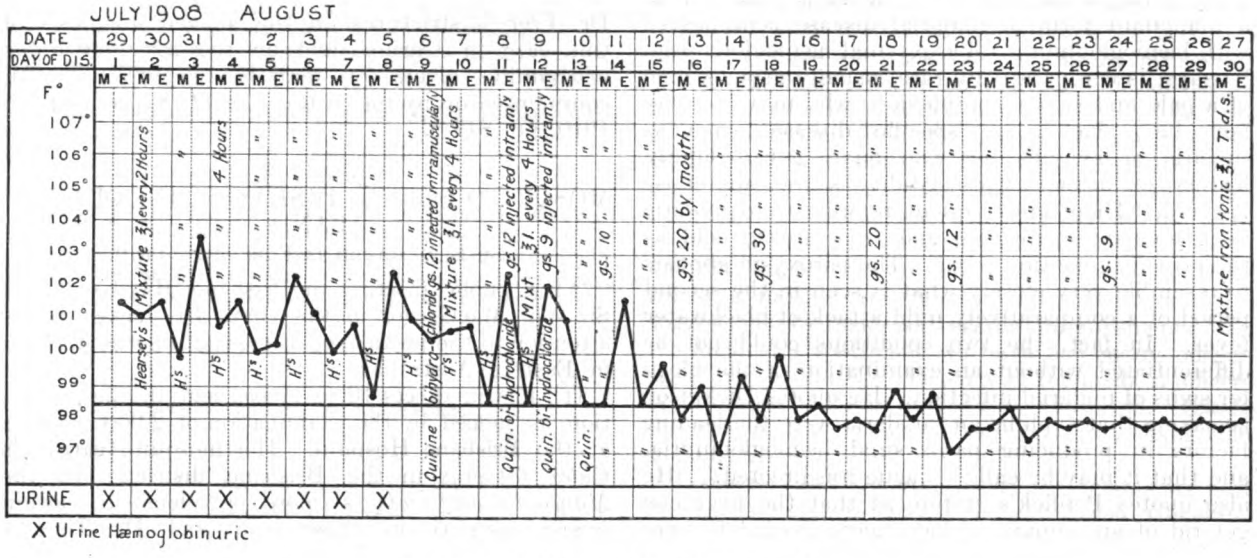


CHART A.—Post-Hæmoglobinuric temperature.

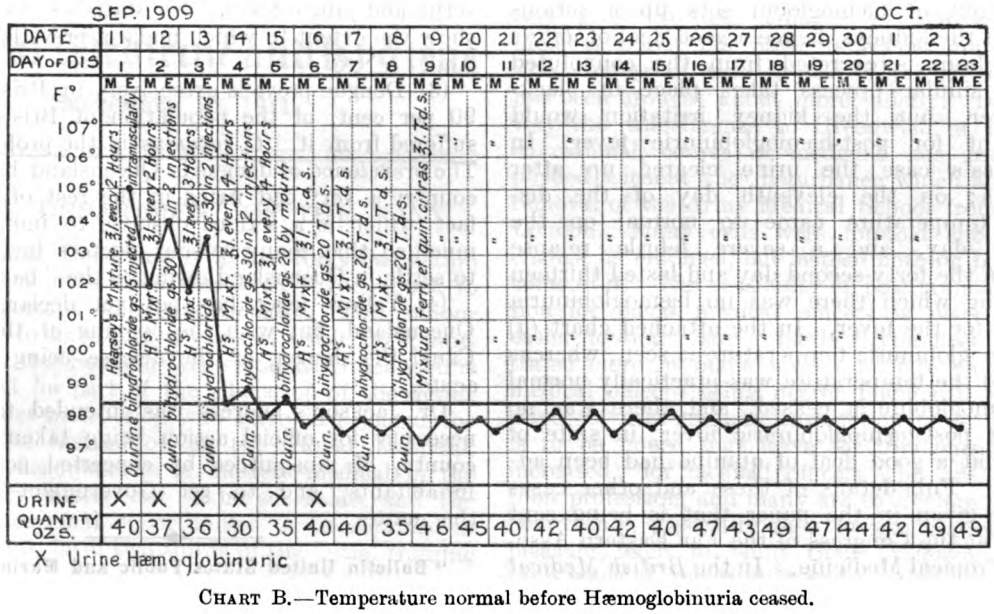
SEP. 1909
OCT.
DATE
DAY OF DIS.
F°
107°
106°
105°
104°
103°
102°
101°
100°
99°
98°
97°
URINE
QUANTITY OZS.
40 37 36 30 35 40 40 35 46 45 40 42 40 42 40 47 43 49 47 44 42 49 49
Hearsey's Mixture ℥i every 2 Hours
Quinine bihydrochloride gs. 15 injected intramuscularly
H^s Mixt. ℥i every 2 Hours
Quin. bihydrochloride gs. 30 in 2 injections
H^s Mixt. ℥i every 3 Hours
Quin. bihydrochloride gs. 30 in 2 injections
H^s Mixt. ℥i every 4 Hours
Quin. bi-hydrochloride gs. 30 in 2 injections
H^s Mixt. ℥i every 4 Hours
Quin. bihydrochloride gs. 20 by mouth
H^s Mixt. ℥i T. d. s.
Quin. bihydrochloride gs. 20 T. d. s.
Mixture ferri et quin. citras ℥i T. d. s.
X Urine Hæmoglobinuric

CHART B.—Temperature normal before Hæmoglobinuria ceased.

Craig does not think that quinine is ever the cause of blackwater fever. In this connection Deaderick says the time intervening between the administration of quinine and the onset of hæmoglobinuria is almost uniformly fixed by various observers at from one to six hours. With six hours as the maximum interval, the cases really due to quinine would

dwindle. It is interesting to note that recently Sir David Ferrier, quoting Fournier's statistics, considers that the tabetogenic effect, which some have attributed to mercurial treatment, has been absolutely disproved.

Dr. Charpentier, in his recently published book on hæmoglobinuria, has gone very fully into the paroxysmal variety, which he describes as a disease *sui generis*, while blackwater fever is regarded as a malignant form of malarial disease complicated with hæmoglobinuria. Paroxysmal hæmoglobinuria, he says, is comparatively rare, usually attacks men of a pale and sallow complexion, who may, or may not, have had some specific disease, such as malaria or syphilis, or who have a bad family history, or, in fact, whose vitality is from any cause lowered. There are frequent references to malaria as a predisposing cause, and exposure to cold as the principal exciting cause. The paroxysm appears to resemble very closely what is seen in the second period of a comparatively mild attack of blackwater fever. In fact, the two conditions could not be differentiated without an examination of the blood for signs of malarial infection. He quotes Dickinson as saying that syphilis and malaria were the leading factors in producing paroxysmal hæmoglobinuria, and that it may be called "ague misdirected." He also quotes Ponfick's statement that the liver can get rid of an amount of hæmoglobin equal to one-sixtieth of the total amount in the blood, and that anything beyond this is excreted by the tubules of the kidneys; also that the excretion of even a small amount of hæmoglobin sets up a serious irritation of the kidneys, hence a good deal of *débris* and epithelium is excreted from the convoluted tubes. A similar process takes place in blackwater fever, but the kidney irritation would not account for post-hæmoglobinuric fever. In Major Ross's case the urine cleared up after three days; on the eleventh day of the disease the temperature came to normal on the eighteenth day, and a severe febrile relapse occurred on the forty-second day and lasted thirteen days, during which there was no hæmoglobinuria to account for the fever. In the attached chart (*a*) a post-hæmoglobinuric temperature is seen, whereas in chart (*b*) the temperature was practically normal before hæmoglobinuria ceased, and there was no subsequent post-hæmoglobinuric fever, in spite of the fact that a good deal of quinine had been administered. Full details of these and other cases have been given in the paper that is being sent to be read at the Congress of the Far Eastern Association of Tropical Medicine. In the *British Medical Journal*, June 24, 1911, which has just been received, a case of blackwater fever in England has been reported by Dr. James Rooth, Brighton. The patient, aged 26 years, had just arrived from Burma, had a touch of fever and began to shiver. He was given 6 gr. of quinine. Two and a-half hours after he passed quite a pint of black urine, the colour of stout. The patient died on the evening of the third day, the urine having cleared up the same morning. In this case the quinine may have been the exciting cause. Dr. Rooth says it would be very interesting to know what number of cases of blackwater fever occurring in this country (England) are recorded, and what the mortality. Is it generally, he asks, a milder form than is found in the Tropics, or is it equally malignant? In the *Lancet*, June 18, 1910, Dr. Frere reported a case of blackwater fever, a Civil servant from Burma. Dr. Frere's strictures on the alleged diagnosis of this case in Burma and on the irregular doses of quinine given for malaria prophylaxis were commented on by me in the *Lancet*, September 10, 1910, pp. 847-8.

## MOSQUITO-BORNE DISEASES IN QUEENSLAND.

By E. Sandford Jackson, M.B., Ch.B.

At a public meeting in Brisbane, His Excellency Sir Wm. MacGregor in the chair, Dr. Jackson drew attention to the prevalence of mosquito-borne diseases in Eastern Australia.

(1) Filaria affects 10 to 17 per cent. of the population, as judged by the examination of 2,000 patients at the Brisbane Hospital. The mosquito carrier is *Culex fatigans* in the Brisbane district, but the *Mansonia uniformis* is more prevalent in certain inland districts in Queensland, and Dr. Thomas Bancroft has found filaria in other mosquitoes than the two mentioned.

(2) Malaria known locally as northern fever, a scrub and jungle fever. No statistics are to hand to show the extent to which malaria prevails in Queensland.

(3) Dengue prevails extensively in Brisbane; some 90 per cent. of the population of Brisbane having suffered from it. *C. fatigans* is the probable carrier. The prevalence of dengue in Queensland has given the country a very bad name in the rest of Australia, a fact which is a serious obstacle to immigration, so much so that many persons, doctors included, refuse to settle in Queensland owing to the "bad climate."

(4) Yellow fever has not yet declared itself in Queensland, but with the opening of the Isthmian Canal the danger of the disease being imported is acute.

Dr. Jackson's address was intended to show the necessity for official action being taken to rid the country of mosquitoes by concerted action of the inhabitants, and to get Government support in the matter.

### "Bulletin United States Public and Marine Hospital Service."

*Soil Pollution by Uncinaria.*—Stiles and Gardner have determined the length of time hookworm eggs retain vitality. In fæces decomposed under water the eggs lose their vitality in ten weeks, and it is not safe to use fæcal matter for fertilizing under three months. Fæcal matter around privies was found infected five months after the privy had last been used.

Reports from Porto Rico bring to light how widely prevalent uncinariasis prevails there; as many as 300,000 cases have been met with since 1904 to the present time.

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THE JOURNAL OF

# Tropical Medicine and Hygiene

SEPTEMBER 15, 1911.


## MEDICAL DEPARTMENT OF THE NAVY.

THE Medical Department of the Navy has within the last few months been rumoured to be about to take an important step educationally. The rumour would seem to have had a basis of truth, for it now appears that the Seamen's Hospital at Greenwich is to be utilized for part of the education of the acting surgeons under instruction who have just joined the Service. The instruction at the Royal Hospital, Haslar, the headquarters of matters medical in the Navy, is very wisely not to be set aside, and the valuable educational opportunities to be obtained in its wards are to form two-thirds of the initial training course.

A change in naval institutions says much for the spirit which pervades the Service. Retentive to a degree of matters of custom and precedent, the Service would appear at times hampered by its very greatness. Custom and wont have prevailed through long periods of time in the Navy in many ways. The sailor's black necktie was first worn as a sign of mourning on the death of Nelson, and for over a hundred years the colour has been preserved. The three black lines on the marginal white braid of the sailor's collar were placed there in memory of Nelson's three great victories—the Nile, Copenhagen and Trafalgar, and they still are worn. Other less prominent customs, not to say revered superstitions, continue to add romance to the sailor's life and a charm to his surroundings.

The medical, in common with other departments, may also have bowed to glorious traditions, for, compared with their medical military brethren, we hear but little of upheavals in the naval service as regards rank, recognition and pay. If silence in this instance means satisfaction, then to those outside naval circles all would seem to be well, and the medical officers would appear contented with their conditions of service. Knowing, however, the loyalty of sailors in all departments to their Service and comrades, and their respectful silence concerning authority and its injunctions, we should not assume that the thinking men of the departments have not many suggestions to make as regards improvements. In the Medical Department we have had many officers of eminence, and the efficiency of the medical officers of all grades has been proved time and again. Lately the title of the medical officers has been changed in some degree.

Inspector- and Deputy Inspector-Generals are now known as Surgeon- and Deputy Surgeon Generals, not Inspectors. This may seem a small matter, but, to those versed in naval and military matters, a most important step. We know the turmoil occasioned in the Army when substantive rank was given to the Officers of the Royal Army Medical Corps, nor have its echoes quite died out. The change of title in the Naval Medical Service has been brought about more quietly. In the same way the transference to Greenwich of part of the educational course in medicine has been accomplished without the disturbance which attended the removal of the Army Medical School from Netley to London. Many evils were foretold should such a change be enforced, but instead nothing but good has come of it. The possibility of post-graduate instruction for naval medical officers is placed upon an easier footing than formerly. The fleet is concentrated more in home waters of late years and the medical officers being nearer home can avail themselves of post-graduate instruction more readily. It is to be hoped that leave for this purpose will be increased; for medical officers who are keen upon their profession, and many are so, declare that life on board ship, especially in a foreign station, however pleasant, tends to blunt their professional abilities from want of opportunity and to stimulate the purely sailor side of their lives to the detriment of themselves and their Service.

There is every evidence that the days of professional stagnation in the Medical Department of the Navy are over. In the School at Haslar modern teaching has been introduced and the Department of Tropical Diseases especially is favoured by excellent teachers and well-equipped laboratories.

## PLAGUE REPORT.

### INDIA.

DEATHS FROM PLAGUE, 1911.

| | Bombay Presidency | Bengal | United Provinces | Punjab | Rajputana and Ajmer-Merawa | Kashmir | North-West Frontier Province | Central Provinces | Central India | Hyderabad State | Madras Presidency | Mysore State | Eastern Bengal and Assam | Burma | Coorg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| January ... | 6,364 | 8,446 | 39,794 | 8,023 | 2,647 | 43 | 19 | 5,067 | 2,404 | 1,032 | 1,594 | 1,386 | 0 | 1,096 | 0 |
| February ... | 6,703 | 11,863 | 43,508 | 13,064 | 3,326 | 27 | 8 | 5,541 | 924 | 784 | 1,050 | 656 | 0 | 1,044 | 0 |
| March... ... | 6,865 | 21,807 | 95,884 | 27,166 | 5,012 | 73 | 31 | 5,245 | 2,115 | 699 | 784 | 458 | 5 | 866 | 2 |
| April ... ... | 6,240 | 13,091 | 81,924 | 57,625 | 4,748 | 294 | 84 | 1,412 | 840 | 250 | 229 | 252 | 0 | 496 | 0 |
| May ... ... | 2,474 | 2,944 | 24 842 | 48,292 | 1,672 | 456 | 88 | 96 | 33 | 8 | 84 | 230 | 0 | 575 | 0 |
| June ... ... | 1,463 | 364 | 1,365 | 16,909 | 389 | 193 | 12 | 4 | 3 | 0 | 185 | 387 | 0 | 651 | 0 |
| | 30,109 | 58,515 | 287,317 | 171,084 | 17,794 | 1,086 | 242 | 17,365 | 6,319 | 2,773 | 3,926 | 3,369 | 5 | 4,728 | 2 |
| Total for the half year January 1 to June 30, 1911 ... 604,634. | | | | | | | | | | | | | | | |
| July ... ... | 3,406 | 350 | 162 | 2,195 | 19 | 0 | 0 | 51 | 12 | 114 | 699 | 1,387 | 0 | 595 | 0 |

### HONG KONG.

| Week ended— | Cases | Deaths. |
|---|---|---|
| April 22 (1911) ... ... | 1 ... | 0 |
| ,, 29 ... ... ... | 0 ... | 0 |
| May 6 ... ... ... | 18 ... | 17 |
| ,, 13 ... ... ... | 7 ... | 4 |
| ,, 20 ... ... ... | 5 ... | 3 |
| ,, 27 ... ... ... | 21 ... | 20 |
| June 3 ... ... ... | 16 ... | 14 |
| ,, 10 ... ... ... | 39 ... | 28 |
| ,, 17 ... ... ... | 30 ... | 23 |
| ,, 24 ... ... ... | 25 ... | 8 |
| July 1 ... ... ... | 16 ... | 12 |
| ,, 8 ... ... ... | 8 ... | 6 |
| ,, 15 ... ... ... | 19 ... | 16 |
| ,, 22 ... ... ... | 15 ... | 15 |
| ,, 29 ... ... ... | 11 ... | 9 |
| Aug. 5 ... ... ... | 13 ... | 10 |
| ,, 12 ... ... ... | 10 ... | 8 |
| ,, 19 ... ... ... | 1 ... | 1 |
| | 255 | 194 |

*China.*—In most of the treaty ports of China plague has occurred during 1911—Tientsin, Chefoo, Shanghai, Amoy, Foochow, Swatow, Canton, Pakhoi, and Laichow. In Manchuria, Pekin, and the Shantung Province the disease has prevailed.

*Indo-China.*—During April and May over 100 cases of plague and 50 deaths from plague occurred in Saigon.

*Siam.*—Bangkok has been more severely afflicted by plague than during any previous announcement. In April and May the disease mostly occurred.

*Japan.*—A few cases have been reported from Kobe, but in Formosa there was a sharp outbreak in April.

*Java.*—In the province of Paseoroean and in Sourabaya plague has been severe during February and March.

*Straits Settlements.*—A few imported cases during 1911.

*Persia.*—At Bushire and Luigah, in the Persian Gulf, outbreaks of plague were recorded during April.

*Arabia.*—At Murkut and at the port of Jiddah a few cases of plague since January 1.

*Egypt.*—Plague has been widely spread in Lower Egypt, and some provinces suffered severely, especially the province of Kena.

*Portuguese East Africa.*—At Nahoria, in May, 1911, a few cases of plague occurred.

*Mauritius.*—January 1 to April 21: 110 cases, with 70 deaths.

*Russia.*—At the Kirgis Steppe (Ashakun) plague prevailed in January, 1911.

*South America.*—In Brazil, Ecuador, Chile, Venezuela, and in Peru plague has prevailed. The disease has nowhere been severe, except at Libertad, in Peru, where during March, 1911, there were 60 seizures and 23 deaths from plague.

## Drugs and Appliances.

OPPENHEIMER, SON, AND CO., 179, Queen Victoria Street, London, E.C., have issued in the form of palatinoids the following calcium salts: (1) Calcium lactate, gr. v., as a specific in the treatment of hæmorrhage; (2) permanganate of calcium, advocated and found useful in gastric ulcer, and in several complaints such as chilblains, rodent ulcer, &c. In the treatment of diabetes, calcium iodide, in 5-gr. doses, has been successfully tried; this salt, owing to its deliquescence, cannot be given in palatinoid form, but is prescribed in pulverette form. Another product of the laboratories of this firm is: Lecithin for neurasthenia, a now well-established and widely used preparation.

## Annotations.

*Typhoid Cholecystitis.*—In the *New York Medical Journal* for August 12, 1911, Bayard Holmes describes a case of typhoid bacillus cholecystitis, without past or present typhoid enteritis and without cholelithiasis. The dangers of such a case are apparent to all, and it is by such "carriers" that the incidence of the disease is largely kept up. In his *résumé* on the subject Holmes states: (1) That typhoid bacillus cholecystitis is an invariable attendant on a typhoid fever. (2) That clinical (obstructive) cholecystitis occurs when the cystic duct is obstructed. (3) That the gall-bladder often retains the infection long after the typhoid septicæmia and typhoid enteritis have passed away, and then the typhoid bacilli may, by use of cholagogues, be found in the stools. (4) That the fate of a typhoid bacillus cholecystitis is so uncertain and so surrounded with danger that the fear of a surgical operation in the course or at the beginning of typhoid fever should not be given too much weight. (5) That the cholecystostomy should be promptly and quickly performed with the minimum of anæsthetic and the minimum of traumatism. No attempt should be made during typhoid fever to remove stones from the cystic duct. (6) That a later cholecystectomy will rarely be necessary. According to Fütterer, as quoted by the author, typhoid bacilli appear in the bile in the gall-bladder as a regular phenomenon in abdominal typhoid fever, and also in every other typhoid bacillus septicæmia. The bacilli gain access to the gall-bladder by way of the blood and the secretions of the liver, and not by way of the common duct or from the blood-vessels in the gall-bladder wall. The bacilli multiply in the gall-bladder and can remain there for many years.

*Intracellular development of* Trypanosoma lewisi.—Minchin and Thomson in the *British Medical Journal*, August 19, 1911, contribute a preliminary note "On the Occurrence of an Intracellular Stage in the Development of *Trypanosoma lewisi* in the Rat-flea."

The authors in studying the early phases of the developmental cycle through which the rat-trypanosome passes in the rat-flea, found that the trypanosome penetrates into the cells of the epithelium lining the stomach (mid-gut) of the flea, and there goes through a process of multiplication. Since no such phase has been observed hitherto, so far as they are aware, in the development of any trypanosome in its invertebrate host, and since, moreover, this discovery may throw some light on certain peculiar features of the development of the pathogenic trypanosomes, they consider themselves justified in bringing forward a brief account of their observations, so far as they have gone, without further delay, hoping to give later a full and detailed account, with figures, of this and other phases of the development.

The intracellular phase of the trypanosome has been seen by them in fleas taken from the breeding-cage, not previously exposed to infection, and fed on infected rats during a known period of time, as early as twelve and as late as thirty-six hours after feeding; but their observations are not yet sufficiently extensive to enable them to place precise limits of time to the duration of this phase. They can only say at present that they find it most abundant about twenty-four hours after the flea has taken up the trypanosomes from the rat, and that it occurs in all parts of the epithelium of the stomach, from close behind the proventriculus to the pyloric region; that is to say, over the whole extent of the true mesenteron or mid-gut, lined by the embryonic endoderm or hypoblast. In this region of the digestive tract the epithelium, as is well known, does not secrete a chitinous cuticular lining to the gut, as in the regions before and behind (stomodæum and proctodæum). This seems an important discovery, and further work on the subject will be eagerly awaited by protozoologists and others interested in trypanosomiasis.

*Experimental Syphilis and Yaws in Rabbits.*—Henry J. Nichols, writing in the *Journal of Experimental Medicine* for August, 1911, on certain features of experimental syphilis and yaws in the rabbit, summarizes the subject as follows:—(1) Lesions of the testicle and scrotum of the rabbit produced by the treponema of syphilis and of yaws afford material for the study of chemotherapy, of serum reactions, and of immunity. (2) On experimental and clinical grounds, it appears that yaws can be cured with a smaller dose of salvarsan than is necessary to cure syphilis. (3) The spirochætæ of syphilis do not become resistant after repeated treatments with salvarsan. (4) Sodium cacodylate has little effect on the treponema of either disease. (5) Mercury, in a single intravenous dose, has a spirillicidal effect, but the necessary dose usually causes the death of the animal later from nephritis. (6) Potassium iodide, in a single intravenous dose, has no spirillicidal effect. (7) The complement fixation reaction is closely correlated with the course of an infection, as is shown by its onset and its disappearance after castration or treatment. (8) Reinfection during the course of a testicular lesion does not occur, but it occurs after regression, treatment, or extirpation. (9) Specific differences between *Treponema pallidum* and *Treponema pertenue* can be demonstrated in infected animals treated with salvarsan and re-inoculated.

## Review.

THE BRITISH SANATORIA ANNUAL. John Bale, Sons and Danielsson, Ltd., 83-91, Great Titchfield Street, Oxford Street, London, W. 1911. Pp. 130. Price 5s. net.

The British Sanatoria for the Open-Air Treatment of Tuberculosis have earned a reputation which is highly creditable to all concerned in their management. The Annual now before us is no mere advertisement, but a guide and help to medical men whose duty it is to select and recommend sanatoria to their patients.

Private sanatoria are met with from Aberdeenshire to Devonshire, and in different situations from the hills in Scotland to the pine-covered sandy levels of Surrey. It may be safely asserted that in Britain the sanatoria are equipped and conducted in manner second to none in the world, and the medical men in charge are of a type on which reliance may be placed.

In addition, there are numerous sanatoria that are free and many at which patients are admitted for treatment at reduced fees. These are in no degree behind the private sanatoria in equipment or in medical attendance. There are also homes and convalescent institutions where tuberculosis in its several aspects are made the object of care and treatment. Messrs. Bale, Sons and Danielsson have done well to give us the information contained in their Annual, which is beautifully illustrated, printed, and bound and should be in every medical man's hands, both at home and abroad.

## NOTICE.

THE DEAF CHILD : A MANUAL FOR TEACHERS AND SCHOOL DOCTORS. By James Kerr Love, M.D., Aural Surgeon, Glasgow. Bristol: John Wright and Sons, Ltd. Pp. 192. Price 4s. 6d. net.

This is a much-needed volume, and will be welcomed everywhere. Dr. Love has done a great service by systematizing the education of the deaf on a medical basis. There seems little doubt that the medical profession until lately have allowed such subjects as the education of the deaf and blind, the physical culture of the people, the great therapeutic value of massage and many other adjuncts of medical practice to be dealt with by, in some cases, lay amateurs, in others by commercial exploiters, and in many instances by quacks and impostors. It is time this was stopped, and that the medical profession, after weeding the chaff from the corn, should control all such teaching and practice. Dr. Love has shown that one section, namely, the teaching of the deaf, is a subject which can only be dealt with scientifically by medical men. The finger spelling by what used to be called the "dumb alphabet" is going out of fashion, and the deaf are being trained to speak. British schools for the deaf are a national necessity, involving as they do also the establishment of a training college for teachers of the deaf. No one can read Dr. Love's book without being filled with enthusiasm for the cause he pleads, and admiration for the manner he has dealt with the subject.

## Personal Notes.

COLONIAL MEDICAL SERVICES.

*West African Medical Staff.*

*Death.*—H. G. Lewer, L.R.C.S., L.R.C.P.Edin., L.F.P.S. Glas., Medical Officer, Northern Nigeria.

*No resignations.*

*Retirement.*—J. B. H. Davson, M.R.C.S.Eng., L.R.C.P.Lond., Senior Medical Officer, Sierra Leone, retires on pension.

*Promotions.*—J. P. Fagan, F.R.C.S., L.R.C.P., L.M.Ireland, D.P.H.Dublin, Deputy Principal Medical Officer, Northern Nigeria, to be Principal Medical Officer, Northern Nigeria.

F. G. Hopkins, M.D., B.Ch.Dublin, Deputy Principal Medical Officer, Southern Nigeria, to be Principal Medical Officer, Gold Coast.

F. Manning, L.R.C.S., L.R.C.P.Ireland, Senior Medical Officer, Northern Nigeria, to be Deputy Principal Medical Officer, Northern Nigeria.

E. H. Tweedy, L.R.C.S., L.R.C.P., L.M.Ireland, Provincial Medical Officer, Northern Territories of the Gold Coast, to be Deputy Principal Medical Officer, Gold Coast.

*Re-appointment.*—R. H. Brierly, L.R.C.P., L.R.C.S.Edin., L.F.P.S.Glas., D.P.H., formerly a Medical Officer in Southern Nigeria, has been re-appointed to the Staff.

*New Appointments.*

The following gentlemen have been selected for appointment to the Staff: L. W. Davies, M.D., Ch.B.Edin., Northern Nigeria; J. B. Alexander, M.B., Ch.B.Edin., D.P.H.Cantab., Gold Coast.

*Other Colonies and Protectorates.*

W. H. Bomford, L.R.C.S., L.R.C.P.Ireland, has been selected for appointment as a Medical Officer in Fiji.

W. Parsons, M.R.C.S.Eng., L.R.C.P.Lond., has been selected for appointment as Medical Officer in charge of the Quarantine Station at Singapore.

E. Sutcliffe, M.R.C.S.Eng., L.R.C.P.Lond., has been selected for appointment as a Supernumerary Medical Officer in the Leeward Islands.

7 *September*, 1911.

LIST OF INDIAN CIVIL OFFICERS ON LEAVE (INCLUDING MILITARY OFFICERS UNDER CIVIL RULES).

*Showing the Name, Province, and Department, and the Period for, and Date from, which the Leave was granted.*

Heard, Major R., I.M.S.

James, Captain J. F., I.M.S., E. B. and A., 6 m., May 3, 1911.

Melville, Major H. G., I.M.S.

Munro, Captain D., I.M.S.B., 12 m., December 1, 1910.

Prall, Lieutenant-Colonel S. E., I.M.S., Aden.

Sykes, Lieutenant Colonel W. A., D.S.O., I.M.S., Beloochistan, 19 m. 1 d, December 16, 1910.

LIST OF INDIAN MILITARY OFFICERS ON LEAVE.

*Showing the Name, Regiment, or Department, and the Period for which the Leave was granted.*

Howlett, Captain A. W., I.M.S., 8 m., from March 1, 1911.

Lloyd, Lieutenant R. B., I.M.S.

Wright, Captain R. E., I.M.S.

Yule, Captain G. M., R.E.

INDIA OFFICE.

*From August 21 to September 11.*

*Arrivals reported in London.*—Lieutenant R. B. Lloyd, I.M.S.; Major H. G. Melville, I.M.S., B.; Major M. Dick, I.M.S., B.; Captain E. W. Browne, I.M.S., M.

*Extensions of Leave.*—Lieutenant-Colonel C. H. Bedford, I.M.S., B., 2 m. M.C.; Major J. Penny, I.M.S., B., 3 m. M.C.; Captain C. J. Brierley, I.M.S., B., 6 m.

*Permitted to Return.*—Captain J. G. G. Swan, I.M.S., B.

## Notices to Correspondents.

1.—Manuscripts sent in cannot be returned.

2.—As our contributors are for the most part resident abroad, proofs will not be submitted to those dwelling outside the United Kingdom, unless specially desired and arranged for.

3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.

4.—Authors desiring reprints of their communications to the JOURNAL OF TROPICAL MEDICINE AND HYGIENE should communicate with the Publishers.

5.—Correspondents should look for replies under the heading "Answers to Correspondents."

## Original Communications.

# THE WATER SUPPLY OF TOWNS IN THE TROPICS, CHIEFLY FROM THE BACTERIOLOGICAL STANDPOINT, AS ILLUSTRATED BY THE WATER SUPPLY OF KHARTOUM.

By ANDREW BALFOUR, M.D., B.Sc., F.R.C.P.Edin., D.P.H.Camb.

*Director, Wellcome Tropical Research Laboratories, Khartoum.*

[This paper is abbreviated as far as page 286, col. 1, seven lines from foot. Dr. Balfour's text commences "at the time when, &c."—ED.]

AS events are trending there may yet be some justification for a lack of faith in the value of *Bacillus coli communis* as an indicator of pollution of a potable water. You are aware that this organism has been put forward by Houston, Savage, Jordan, and others, as, with certain restrictions and reservations, a reliable test of the purity or otherwise of a water-supply.

Dawson advocates the preparation of contour maps of the subsoil water and discusses the filtering capacity of soil. One point he specially brings out is that if the subsoil contains much clay, especially black clay, in which there is a large percentage of organic matter, a process of purification by natural filtration is impossible, and there exists indeed a culture medium.

Turning now to papers dealing more exclusively with the bacteriological aspect of the question, we find Daniels and Finlayson reporting upon the natural waters of the Federated Malay States. These are jungle streams, and Daniels remarks that the organisms present in such water are abundant, and differ in type from those met with in temperate climates or in tropical climates where the rainfall is less uniform and vegetation not so rank. It is therefore evident that no general rule can be applied to water-supplies in tropical countries as a whole. Each must be judged on its merits, and it will be a long time before sufficient facts will have accumulated to enable us to compare the waters of hot, dry, desert countries like the northern Sudan with those of steamy, humid regions where vegetation is rife and the rainfall is heavy.

However useful, then, this work was for local purposes, it does not help us much in considering the question as a whole, and until recently there were, so far as I know, no statistics of value in this direction. Happily the first step has now been taken by Major Clemesha and his assistants, who have inaugurated in India a series of observations which may yet prove to be epoch-making and are already highly suggestive.

Major Clemesha stated in the first instance that there must be considerable doubt as to whether the standards of purity in common use amongst sanitarians in England were suitable to India. The simpler tests when applied to Indian water samples showed that most of the latter are loaded with fæcal contamination, and that no analyst in England would dream of passing them as fit for human consumption. And yet it is remarkable that the evil results of using such sewage as drinking-water are not always apparent, even on inquiry. True, there are outbursts of epidemic cholera and dysentery, and there is a terrible infantile mortality; but, all things considered, the results are not in proportion to the cause *at all times*. Again, a great deal of the pollution of surface waters in the East is caused by the excrement of animals, chiefly cattle and goats, whereas in England the pollution of rivers at least has its origin largely in the sewage from towns upon their banks. After these preliminary remarks and others which need not be quoted, Clemesha proceeds to give an account of the bacteriological methods he and his assistants followed in their efforts to arrive at a suitable standard of purity for the drinking-water in the Madras Presidency.

An important chapter in Clemesha's report is that in which he considers the "coli" standard as applied to India. He points out how bacteriologists differ in their definition of *B. coli communis*, and he gives the interpretations put upon it by four authorities, namely the English Committee, the American Committee, Houston and Savage.

Major Clemesha considers (1) That it is inadvisable to apply the term "coli communis" to a group of organisms, or even so-called varieties, and (2) the tests laid down as essential, according to the definitions quoted, do not go far enough; that the list contains too many that are of doubtful significance and utility and too few that are admittedly of greater importance in the identification of a bacillus.

Major Clemesha by a study of the question came to the following conclusions:—

(1) That standards in use in cold climates are useless and worse than useless in tropical countries.

(2) That it is necessary to separate the individual species of bacilli by well-established tests, and to study their characteristics and their position in nature.

(3) That it was advisable to classify all lactose-fermenting organisms according to their ability to resist the action of sunlight, and on this to base the standard of bacterial purity.

Next the change in the bacteriological flora of water and fæces during monsoon weather was made the subject of an investigation.

Dr. Balfour then gives an account of Major Clemesha's investigations:—

(1) A systematic analysis of the water of a shallow well at the King Institute.

(2) The bacteriological flora of the fæces of man and other animals.

(3) Ingenious and laborious methods to determine the effect of sunlight on fæcal organisms.

As a result of all this work it was evident that delicate organisms, such as *B. coli communis* and *B. oxytocus perniciosus*, exist in nature along with the resistant forms of which *B. cloacæ* and *Grunthal* may be taken as examples, while between the two groups come intermediate species such as *B. lactis aerogenes*. These, then, are the three classes into which Clemesha divides organisms which are of importance in the bacteriological examination of water, and many of which, let it be remembered, are included in Houston's elastic term, true *B. coli*.

Major Clemesha then applies his classification to practical purposes, *i.e.*, to establishing bacteriological standards for drinking waters in India.

In summing up he says of river waters :—

"*Good river water* should not contain more than 100 colonies (on agar at 37° C.). Fæcal organisms should not exceed 1 in 10 c.c. No organisms of Class I. should be present in 50 c.c. Fæcal organisms present should belong to either Class III. or the more resistant group of Class II."

"*Fair or usable river water* should not contain more than 300 colonies (on agar at 37° C.); should not contain more fæcal organisms than 1 in a c.c., and no organisms of Class I. in less than 20 c.c. The fæcal organisms present should consist mainly of mixtures of Class III. and Class II., and there should be a tendency for one organism to preponderate."

"*River waters should be condemned if* total colonies are more than 800 (on agar at 37° C.). If lactose fermenters are present in number of 10 to 100 per c.c. If organisms belonging to Class I. exceed 1 in 5 c.c. Or if the fæcal organisms isolated (Class I. being absent) are rich in varieties such as occur in an emulsion of fæces." And then turning to well and spring waters remarks :—

"*A good water* should contain no fæcal bacilli in 20 c.c. No Class I. in 100 c.c. Total colonies under 50 per c.c. We are for the present unable to give any other standards than this."

Clemesha confesses that he cannot tell how far his method is applicable to the waters of springs and wells which are not exposed to the direct action of sunlight. He admits that in these cases the question is much more complicated than when one is dealing only with surface waters, the difficulties being (1) to estimate the importance and significance of organisms that remain alive in the soil for long periods, and (2) to be quite certain when a pollution is caused by surface contamination washed down through cracks or through a porous soil.

The quantity of fæcal pollution he regards as of paramount importance in the case of well water, and the standard he adopts has been given. This, of course, applies only to surface wells. He tells us nothing regarding deep wells, and here it is that I hope to make good a deficiency and to show that in Khartoum, at least, the standard of Houston and Savage has proved itself a reliable guide in an interesting and difficult problem. I hold no brief for Major Clemesha and his work. It requires confirmation and may be refuted. At present Captain Archibald is working on similar lines with river and shallow well water in Khartoum, where, however, conditions differ considerably from those in Madras. But whatever may eventually be proved there can be no doubt that the Indian work is in the right direction, and that it has been carried out with much care and devotion and in an eminently sensible and scientific manner.

At the time when it became necessary to embark upon water work at Khartoum, Clemesha's researches had not appeared, and one had to proceed more or less on the old familiar lines. I have mentioned the Blue Nile, a river clear when low, with very palatable water of an agreeable softness and colour, and comparatively pure save where fouled from the bank at a town or village. I need not enter here into the chemical composition of its water. In flood time it is, of course, muddy, laden with silt and washings from the Abyssinian mountains. Some records of bacteriological observations are available, though several were destroyed in a fire. Those existing show that in January, 1907, at low Nile the number of organisms in 1 c.c. of the water taken close to the bank above the town was between 300 and 400 (agar count at 37° C., forty-eight hours incubation), while in a sample taken from the centre of the stream at Burre in February, seventy-seven organisms were found per 1 c.c. In May, with the river rising, a sample taken from mid-stream opposite the Gordon College gave eighty-four organisms. Other observations show that the counts vary considerably, and close to the bank as many as 700 colonies per 1 c.c. have been found, while *Bacillus coli* of an excretal and "flaginac" type is commonly present in from 5 to 1 c.c. of water taken close to the bank, but is not found in less than 5 c.c. of water from mid-stream. Formerly the Nile served as the chief source of supply, so far as drinking water is concerned, and so long as the water was not stagnant did not appear to be a cause of communicable disease for reasons I have stated elsewhere. (Third Report, Wellcome Research Laboratories, 1908, p. 84.)

Water for washing, cooking, irrigating gardens, and watering animals was in the main derived from the numerous shallow wells with which the site of the town is honeycombed. Such water is always impure from a chemical standpoint, and also from what we may call the English bacteriological standpoint. It is hard and often contains *B. coli* of a "flaginac" and excretal type in so small a quantity as 0.02 c.c. I have known *B. pyocyaneus* to be present in such water, and have also seen its use result in dysentery, and systematic pinking of such infected water led to a cessation of the cases it had caused. In this connection there is to hand an excellent type of apparatus for taking water samples from wells and rivers of a type not figured in the text books. When the question of an improved water supply came up for consideration, it was evident that only two sources were available.

(1) The river; the supply to be taken above the town.

(2) Deep wells, if such could be obtained.

The advantages of the river supply were that the water was known to be palatable, that there was an unlimited quantity, that it would be popular with the natives, and that the works required were not likely to be expensive. Its disadvantages were the necessity for the construction of settling tanks, unless the water could be obtained through pipes sunk in the sand banks or by means of galleries beneath the river bed. Moreover, as the river water was certainly liable to pollution from the banks, and from boats and steamers, it could not be relied upon as a permanent supply without filtration, and filters, even mechanical filters, are to be looked upon with suspicion, especially in a country where native labour has to be employed.

The advantages of a deep well supply were that in all probability a clear and pure water would be forthcoming and that such water would be safe from pollution and would not require filtration. Its disadvantages consisted in possible heavy expense and in the chance that the supply might be inadequate or the quality unsuitable. It might be excessively hard or contain iron in undesirable quantities, or be of such a nature as to require special treatment. In short, one knew where one was with the river supply; one was totally in the dark as regards the deep wells, for nothing was definitely known regarding the geological formation and there was nothing to guide one in a new country like the Sudan.

After some discussion, it was decided to have a trial boring sunk which would both furnish information regarding the strata and enable samples of water to be obtained for chemical and bacteriological examination. At the same time I set on foot some inquiries into the flow of the subsoil water and its relations to the Blue Nile. A site was selected above the town and close to the southern bank of the Blue Nile, and operations were commenced with great energy. Indeed, so great was the energy displayed that instead of a single trial bore the whole of an elaborate scheme of well-sinking was carried through, nor could it be checked despite protests and representations from those responsible for the public health. Proper samples for analysis could not be obtained for months, and when at last the engineers declared themselves ready to submit such samples it was found that six wells had been sunk; but as a seventh was afterwards drilled it will be convenient to describe the installation at a period just prior to that when the final tests were made.

The site has already been stated. It suffices to say that no great distance away lies the village of Burri which is served by shallow wells liable to pollution.

The waterworks, as will be seen, consisted of seven wells and a pumping plant. Since then a large, covered reservoir has also been provided. The wells lie along two lines, one at right angles to the river, the other nearly parallel to it. Well No. 5 in the first line is 30 yards from the river bank. The wells are about 60 metres apart, are drilled and at that time were of the following depths, *i.e.*, Nos. 1, 2, 3, 4, 5 and 6 of 75 metres and No. 7 of 176 metres, these depths being, to all intents and purposes, from ground level.

Wells Nos. 1 to 6 were alike in being fitted down to a depth of 22·40 metres with a casing pipe of 9½ in. diameter. Below this point, the bore-hole, 8 in. in diameter, extended unguarded to the full depth of 75 metres.

Well No. 7 was cased with a 6⅝ in. pipe down to 54 metres, while the unguarded bore-hole of 6¼ in. diameter extended below this to the full depth of 176 metres.

As has been said, there was originally no reliable information regarding the geological structure of the site. Some details had been gathered and sections prepared when No. 1 well was drilled, but as there was no core-boring and the material was washed out in a finely comminuted state the information furnished could not be regarded as very reliable. Indeed, subsequent observations proved it to be incorrect in certain particulars.

So far as could be told the upper strata down to a depth of 23 metres consisted of layers of sand, clay, mud and gravel. Immediately below came rock seamed, so it was said, by beds of clay. This rock, there was reason to believe, was a porous limestone, a "Travertine," as it is called, but at the time the first tests were made no information was forthcoming regarding its nature. It was understood, however, that the casing pipes ended in it and not, be it noted, in any impermeable bed of clay. At first, indeed, this rock was said to be sandstone with a layer of clay marl overlying it and it was assumed that a more or less similar formation existed in the case of each of the first six wells. Anyhow, below this doubtful stratum was the water-bearing sandstone which was shown as coarse and containing gravel. The earlier sections showed the rock to be seamed at different levels with clay marl.

There had apparently been a fault between well No. 7 and the other wells for, in its case, below 23 metres the strata differed in position and thickness. One need not, however, go into details nor is it necessary here to enter into the question of the quantity of water yielded at first by these wells as our time is so limited; but a word or two may be devoted to the air-lift pump, the method of water-lifting eventually employed. The air-lift, which is not strictly a pumping machine, was, I believe, originally an American invention which under certain conditions renders excellent service. Its principle of action is the lessened specific gravity of water in which air is contained in considerable quantity, or through which it is rising in bubbles. There is an air-pump or compressor and from it an air-pipe passes to the bottom of a water tube, into which tube air is discharged. The air rising causes the surface of the water to rise, since the atmospheric or other pressure at the base remains the same. The output from deep wells can thus be increased although the total mechanical efficiency of such a plant is said to be less than that of a good pumping installation. One mentions it here as, naturally, its influence on the bacterial content of the water required consideration.

As may be surmised the very scanty information obtainable regarding these wells did not place a bacteriologist in a very favourable position for coming to definite conclusions regarding the results he might obtain on analysis. The responsibility was great, the problems novel, and there was determined opposition to sanitary interference. One could not tell if heavy rains falling on a cracked and gaping surface soil might not wash impurities to such a depth that they could enter the well water by the unguarded bore holes, one could not tell if, under the influence of powerful pumping with great depression of the water table, river water or water from pools in the dried river bed might not similarly gain entrance. From

the river bed to the top of the unprotected bore hole of well No. 5, there was only 13 feet of sand in a vertical direction and 90 ft. of presumably porous material in a horizontal direction to act as a "natural" filtering medium. Again there were the shallow native wells in the neighbourhood which certainly merited some consideration. One felt doubtful about the whole scheme. There might be little evidence of pollution and yet the water might, under certain conditions, be a source of danger. One had been confidently assured that the water was the finest in the world, and had replied with the expressive Arabic word "Yimkin," which, being interpreted, signifieth "perhaps." If at first the results were good it might be difficult to prevent the water being rushed upon the town, although it was evident that the tests would have to be prolonged and careful. The influence, if any, of the falling and rising Nile upon the wells certainly called for study, as did the effect of severe and exhaustive pumping.

It was, I confess, an anxious time and one was scarcely prepared for the results which were obtained. Before mentioning these one must outline the methods of examination employed.

Water was collected from the wells in special sterilized glass-stoppered bottles. The discharge was as a rule from a special wrought-iron pipe of small diameter leading from the large delivery-pipe directly connected with the well. The small pipe was passed through the furnace every morning of the days on which samples were taken. Its faucet was also flamed prior to collection of the samples. As a rule three samples were taken from each well, and at least two of them were examined.

The bottles, after their necks and stoppers had been flamed, were filled, placed in ice and transported by motor or launch to the laboratories, where the examination was commenced as soon as possible, nearly always within half-an-hour of the time of taking the samples.

*Quantitative Examination.*—The samples were plated on the usual nutrient agar (1 per cent. to phenol-phthalein) and the quantities usually employed were ·2 c.c., ·3 c.c., ·5 c.c., and 1 c.c. Occasionally ·2 c.c., plates were also poured. The plates were made in duplicate and often in triplicate. As a control one set of plates was poured by me from one water sample and another set by my assistant from another sample. Now and then the third sample was also utilized for making plates. In addition control plates were made with agar alone and with agar to which sterile water was added. The plates were incubated for forty-eight hours at a uniform temperature at 37° C. and then counted. Occasionally there was trouble with the incubator, and when a temperature of 37° C. could not be maintained, the plates were allowed to remain for a longer time in the incubator.

As a rule the technique proved satisfactory, but on one occasion it was found that the stock agar had an inhibitive action on bacterial growth, owing probably to faulty preparation or standardization and the counts made on this agar were discarded.

Further, on several occasions the presence of haboubs, or high winds with dust, resulted in air colonies getting access to the plates and ruining the work. It was found impossible to prevent this contamination.

*Qualitative Examination.*—The presence or absence of *B. coli* was determined at every examination. For this purpose the following standard media were employed:—

Glucose bile-salt neutral red broth with Durham's tube for gas formation, MacConkey's glucose, peptone, bile-salt medium, with Durham's tube, and latterly the new lactose-bile medium of Jackson with Durham's tube, which constitutes the most delicate presumptive test for the presence of *B. coli*.

The quantities of water examined were as a rule 5 c.c., 10 c.c., 25 c.c., 50 c.c., and 100 c.c. When any suspicious appearances were observed confirmatory tests were employed; the organisms present being plated out on the Endo or Drigalski-Conradi media or on lactose bile-salt neutral red agar and then examined for indol and subcultured into the usual milk, sugar and litmus media, as well as examined microscopically.

I may say that, on the whole, the Endo-fuchsin agar yielded the best results. When considered necessary the *B. enteritidis sporogenes* test was applied and a search made for streptococci. When essential the pathogenic effect of a suspicious microbe was tested on animals—gerbils, jerboas, fowls and guinea-pigs. In short the method favoured by Savage was closely followed.

The condensation water in the air-pipe line serving the air-lifts was also examined bacteriologically.

Routine observations as regards the temperature of the water for different wells tested, and as regards the level of the ground water in the wells, were made while the tests were being conducted. The data as regards levels were furnished by Mr. Williams, the engineer of the waterworks.

I have said that the results of the first examinations were surprising. They were such as to lead to an immediate condemnation of the water, both on bacteriological and chemical grounds. Samples were found to be faintly opalescent, becoming more so on standing, and depositing a very small amount of sediment. The taste was faintly chalybeate. The colony count varied between 1,000 and 2,000 per 1 c.c. *B. coli*, as a rule of a "flaginac" and excretal type, were present in 1 c.c. and larger quantities, the free ammonia figure ·5 to ·6 parts per million was excessively high, and iron and manganese were present in objectionable quantities;* 1·33 parts of iron per million and ·17 of manganese clearly indicated that there would be trouble with crenothrix growth in pipes to which such water was admitted, and this proved to be the case, *C. polyspora* speedily making its appearance.

According to Hazen ·5 parts of iron per 1,000,000 is about the permissible limit, while, in the Rod-el-Farag well water in Cairo, trouble had ensued with

* Much free ammonia, unaccompanied by "albuminoid" however, as is well known, is frequently found in waters containing iron, and is derived from the reduction of nitrates.

·35 parts per 1,000,000 of iron and ·77 parts manganese.

Dr. Beam, our chemist, and I reported that as a result of the examination and a study of the topography of the well district we were led to believe—

(1) That the iron and manganese are derived from strata and will persist in the water.

(2) That we are dealing with a mixture of deep well water whose source is the Blue Nile, and of superficial or ground water highly charged with micro-organisms, which is gaining access to the wells either through defective joints in the pipes or, what is more likely, through cracks and fissures in the strata or through porous beds.

Naturally this adverse report did not please those who had forced on the water scheme without due precaution, deliberation, and the necessary inquiries and tests. Only one well had been tested, and the conditions of sampling were said to be unsatisfactory.

Proper pumping trials with ordinary pumping apparatus were now commenced, the mixed water from five wells was examined with every precaution, and the results, as will be seen from the conclusions to our report, were much the same. We stated that—

"(1) From a physical standpoint it is apparent that the water is quite unsuitable for a town supply. It is not clear when freshly pumped and becomes distinctly turbid on standing. Moreover, as predicted, the presence of iron and manganese in the water has resulted in the rapid growth of the Crenothrix fungus and the development of an odour distinctly disagreeable. The taste is also somewhat unpleasant.

"Such a water would infallibly cause serious trouble by leading to a blocking-up of the service pipes, especially those of small calibre. The greatest trouble would result when the iron-stained filaments of the fungus break off and become diffused throughout the water. This renders the water quite unfit for laundry use, owing to the unsightly and destructive deposit of ironmould on linen and other fabrics. Moreover, it is not to be expected that people would pay water rates for water of this character.

"In this connection we may cite the so-called 'water calamity' of Berlin, and the similar calamities recorded from Rotterdam, Charlottenburg, and many other places, including, to come nearer home, the recent revelations in Cairo. It is true that aëration combined with filtration will, in most cases, remedy this evil, but the filtration must be efficient, as there is already a case on record of an incompletely filtered water, from which the iron was not wholly removed, resulting in the growth of crenothrix.

"(2) From a chemical standpoint the water still remains much harder than that of the Blue Nile, and a soft water is always preferable for a town supply from an economical standpoint, owing to the action of hard water on boilers and soap. The presence of iron is, of course, objectionable, chiefly for the reasons already detailed.

"In our former report we mentioned that the quantity of iron is far in excess of what is permissible in a town supply. The slight reduction in total solids and carbonates indicates that the forced pumping has resulted in the drawing in of a larger amount of the water to which the contamination of the deep well water is due.

"(3) From a bacteriological standpoint the water is in much the same condition as it was at the time of the former examinations, so far as the presence of *B. coli*, the standard bacterial indicator of impurity, goes.

The number of organisms present in 1 c.c. is greater than that present in the last sample taken from well No. 3 on January 19. The results of the examination of this sample have not been submitted to the Board as the analysis was still proceeding at the time of the last meeting; 218 micro-organisms were then found per 1 c.c., and true "Flaginac" *B. coli* was present in 1 c.c. of the water.

Hence there has been very little change, and what change there is has occurred in the wrong direction. In a pure, deep well water the bacterial count at blood heat should not exceed five to ten micro-organisms per 1 c.c.

As stated, *B. coli* is taken as the standard of pollution, and the presence of *B. enteritidis sporogenes* merely serves to add confirmation to the evidence of pollution.

This organism should not be present in less than 1,000 c.c. of a deep well water. Here it has been found in 500 c.c. In shallow well waters it should not occur in 100 c.c.; hence it was not necessary to test for it in lesser quantities than half-a-litre.

As regards streptococci they have much the same significance as *B. coli*; in other words, when present in large quantity they indicate fæcal contamination, but their position as precise indicators is not yet assured. It will be noted that they were present in 0·1 c.c. of the water. As compared with Blue Nile water it is evident that bacteriologically the samples of well water examined were just about four times as bad. I was now somewhat in the position of Pooh-Bah in the "Mikado." As Government bacteriologist I condemned the water, and as Medical Officer of Health I refused to accept it. Personally I was inclined to make a stand for river water and infiltration, or at least to insist on filtration of the well water.

With the scanty information available it was impossible to come to any definite conclusion regarding the source of pollution. Noting, however, a certain ratio between the numbers of micro-organisms present in the well water and those in the Blue Nile water, I concluded that the river water was finding its way into the wells, and, considering Dawson's views, which I have already cited, I hazarded the opinion that one or other of the soil layers was acting as a culture medium and that, under conditions of increased temperature and favourable nidus, the organisms in the river water were multiplying *in situ*. The type of organism found on the plates favoured this hypothesis. That this view was in all probability correct, I may at once declare, for further investigations proved the existence of a bed of bluish shale.

As there was also a doubt regarding the quantity of water available it was decided to obtain the advice of

Mr. Abel, of Cairo, a well-known hydraulic engineer. He was accompanied by Dr. Todd, of the Egyptian Public Health Department, who acted as Mr. Abel's personal adviser on the bacteriological aspect of the question. Their visit unfortunately took place at a time when the laboratories were partly gutted by a disastrous fire, and Dr. Todd's work had to be limited, but they had the advantage of being given every facility and full information, as it was hoped their investigations would put a different complexion on the case, especially as the air-lift plant had been installed and was in use. So far as the chemical and bacteriological analysis went this was not the case. The work done in the laboratories was amply confirmed, and their report only differed from ours in declaring that any true surface contamination was impossible. In this, I believe, they were perfectly correct. Further acquaintance with soil conditions has assured me on this point, though my chief fear was that water from polluted pools in the river bed at low Nile might find its way into the unprotected bore holes.

One cannot enter into their interesting inquiries and elaborate tests in detail, but it is useful to tabulate their results. These are as follows :—

"The results of the bacteriological tests show that at the time of the trials the water was far from satisfactory from a hygienic point of view.

"The two wells which were subjected to a more or less detailed examination gave evidence of a somewhat intense and irregular pollution.

"For reasons given above, it was not possible to definitely locate the source of the pollution; but from the results of certain tests we were forced to the conclusion that the water which enters the wells from some of the upper layers tapped must be highly contaminated.

"How this contamination arises is a question which we are unable to settle, from want of sufficient data; but we are convinced that any true surface contamination in the immediate vicinity of the wells is out of the question.

"Concerning the chemical constitution of the water, we are not inclined to lay much stress on the results of the analysis available, as these are hardly sufficiently numerous, nor do they cover a long enough period.

"They, however, appear to show that, apart from the presence of iron and manganese, no serious objection can be raised from a purely chemical point of view.

"Should iron and manganese ultimately prove to be present in quantities large enough to create difficulties, these would in no way be insurmountable, and the question would be merely one of expense."

Their recommendations are of special interest. They advised :—

"(1) The cutting off of the upper strata in the wells down to a certain depth.

"(2) The improval of the compressed-air plant, so as to guarantee continuous working and avoid contamination of the wells from the air-lift.

"(3) A continuous pumping trial, extending over a period of at least a fortnight, with regular measurements of the output and depression.

"(4) A series of bacteriological and chemical tests made at suitable intervals throughout the above trials.

"If these tests give satisfactory results, so that regular pumping from the wells is begun, the following might be proceeded to :—

"(5) A periodical bacteriological control.

"(6) A regular chemical examination of the well-water with a parallel examination of the Nile.

"(7) The deepening of wells Nos. 5 and 6 to about 200 metres.

"(8) The boring of a new well at a point suggested, and taking advantage of this boring in order to obtain accurate information both as regards the various strata and as regards the water carried by these."

I may say that they were led to believe that the sandstone layers belong to the Nubian sandstone—which is said to reach from Uganda to Assouan, and that they are therefore extensive water-bearing strata fed mainly by water derived from the Nile. Further chemical examinations have led Dr. Beam and myself to regard this opinion as correct. The deep water is probably derived from the White and not the Blue Nile, and it is likely that it has travelled a long way underground.

Messrs. Abel and Todd who were put in possession of information regarding the "Travertine" bed of which we were ignorant, made the interesting discovery that strata of similar material crop out on the banks of the river east and south-east of the town. It is therefore possible that this layer places the wells in direct communication with the river, the porous bed extending some two miles or so from the site of the wells to the river outcrops. This, and the presence of the bed of bluish shale, which was found to exist immediately beneath the "Travertine" and to be about 6 metres in depth, would, in my opinion, adequately explain the results at first obtained, *i.e.*, the evidence of a mixture of pure deep well water and of water which, from the English bacteriological standpoint at least, was grossly polluted. Granting these conditions exist, could such water travelling into the wells from the river cause disease under any known conditions? I believe it might. There are native villages above the outcrops, and there is a certain amount of boat and steamer traffic. Given enteric fever, dysentery or cholera, I do not see why specifically contaminated river water might not reach the wells. It is true that in the bed of bluish shale saprophytic organisms might successfully combat the pathogenic, but we know that *B. coli communis*, at least in some of its forms, is not a very resistant organism and yet it was present in very small quantities of the water. In the case of Nile water also one has to consider such diseases as bilharziosis and dracontiasis. At any rate, as will be shown, *B. coli* gave clear indication of the contamination or, if you will, admixture of the true deep water

with superficial water. Even supposing the *B. coli* found were to fall wholly into Clemesha's third group, I think it would have been the height of absurdity to pass wells which at very heavy expense presented the town with water—one half of which at least, let us say, was derived from the very river which flowed past 30 yards away from one of them. This, too, apart from the important question of the contained iron and manganese.

Happily, the laboratory representations prevented this water being supplied to the town and in my Public Health Report for 1908 I wrote "one can only hope that some means will be devised whereby the water may be obtained free from chemical and organismal impurities.

"If this is found impossible, then filtration must be employed, or, if necessary, the Blue Nile water utilized and passed through bacteriological filters. The threatened invasion of cholera last year renders this water supply question most urgent and important." Fortunately, the question was solved, and satisfactorily solved, along the lines suggested by Messrs. Abel and Todd. The upper strata were cut off with cement and, as a result, the colony count fell well-nigh to zero, *B. coli* vanished and the quantity of iron and manganese greatly diminished. As this engineering device may not be generally known to medical men it may be well to indicate how it was carried out. I am indebted for particulars to Mr. J. E. Williams, the engineer in charge of the works, who at all times was most courteous and obliging. The process is simple enough. As noted, with the exception of No. 7 which was of smaller bore, the wells down to a certain depth were lined with a casing tube of $9\frac{1}{2}$ in. diameter. A second tube of $6\frac{5}{8}$ in. diameter was passed down each well to the depth where it was desired to cut off the upper strata, *i.e.*, to one or other of the deep beds of impermeable clay. This inner tube therefore descended in the open bore hole below the level of the end of the outer tube. In order to facilitate operations the well was first of all filled with sand which provided the necessary cushion. Liquid cement was then poured between the two tubes down to the depth desired, and in cases where it did not settle properly it was blown down and packed by means of compressed air. It set for the most part under water and formed a hollow column or ring, the lower portion of which, confined between the inner tube and the wall of the bore-hole, in some degree soaked into the porous sandstone with which, as stated, it was in contact and rendered the latter absolutely impermeable. Although transverse fissures may occur in such a column, it is scarcely conceivable that any lengthy vertical crack can be produced in it. Hence the cutting off is regarded as efficient. Finally, the cushion of sand was blown out of the well which, if the clay bed is both extensive and impermeable, is thus wholly protected from any local influx of water from upper and possibly contaminated strata.

I will now conclude what, despite many omissions, has, I fear, proved a lengthy paper by quoting from portions of my final report to the Sudan Government on the examination of the well waters before and during special and continuous trial pumpings of twenty-one days' duration in the months of March and April, 1909.

"The wells tested were Nos. 1, 5, 6 and 7, and the first three at the time of the special pumping trials had undergone very extensive alterations since the examinations conducted in 1907-08. For one thing the air-lift pumps and air compressors had been introduced, while well No. 5 had been deepened and in all the upper strata had been cut off by a special process. No. 7 was a new well to us. It had been bored since the last examinations. As a result of these changes we soon found that we were dealing with quite a different water from that which had led to a condemnation of the original wells. Nos. 2, 3, and 4 have been discarded and filled up with sand.

"As, from previous experience, confirmed by the results obtained by Messrs. Abel and Todd, we were aware that the old wells had been contaminated by the influx of polluted water from upper strata, it was of the highest importance to ascertain:—

"1. If the beds of clay, separating the polluted water in these strata from the deeper water, were or were not impermeable.

"2. If the methods of cutting off the upper strata by means of iron tubes and cement rings were or were not adequate.

"For this purpose we maintained that continuous pumping trials extending over a period of twenty-one consecutive days were essential so that a maximum depression might be obtained in the wells, which in this way would be subjected to a trial more severe than any they were likely to undergo when being pumped on for the town supply.

"The condition of the wells which were tested in groups of two was as follows:—

"No. 1—Depth 100 metres. Upper strata cut off to a depth of $65\frac{3}{4}$ metres.

"No. 5—Depth 112 metres. Upper strata cut off to a depth of $69\frac{1}{2}$ metres. Combined yield 18,000 gallons per hour.

"No. 6.—Depth 75 metres. Upper strata cut off to a depth of 63·82 metres.

"No. 7.—Depth 176 metres. Upper strata cut off to a depth of $72\frac{1}{2}$ metres. Combined yield 21,000 gallons per hour."

It would take far too long to give the results in detail. Their general consideration as stated in the report will suffice.

So far as wells No. 1 and No. 7 go, these do not call for any lengthy discussion. In both cases, and especially in No. 7, the colony count has almost throughout been uniformly low and compatible with that obtainable from true deep wells containing water free from bacterial impurity. On three occasions, March 18, 21 and 22, on which the count has exceeded 50 colonies per 1 c.c., the results can probably be adequately explained by the hypothesis that some of the foul condensation water from the air-pipe line was forced into the well. Personally I am almost certain that this did occur on several occasions

and accounted for the greater number of colonies.* Excluding these abnormal counts the average colony count for both wells work out at 5·8 per 1 c.c.

Further, and this is of greater, indeed of paramount, importance, *B. coli* has not once been found in either of these waters in the quantities (100 c.c. and under) examined, nor has any other objectionable organism been found.

Hence *at the present time* the water of these two wells may be passed as a good drinking water, the only possible objections to it being that it is not well aërated and that it is warm, both faults which can be readily remedied.

The slight odour of sulphuretted hydrogen in No. 7 well water does not call for any special criticism.

Taking next well No. 6 we find that its water closely resembles that found in No. 1 with a single exception. For the greater part of the trials there was present in it an organism closely allied to, if not identical with, *B. proteus fluorescens.*† It is necessary to consider the precise significance of an organism of this type in a deep well water. Its morphology and cultural characteristics have been often discussed, and, as the same organism was present in No. 5 the remarks here made will apply, so far as this matter is concerned, equally to that well water. As has been pointed out *B. proteus fluorescens* is an organism capable of developing and multiplying in bile-salt media, and it is well known that the majority of organisms which do so are to be regarded with suspicion. Moreover this is the very bacillus which Jager and others have claimed, apparently with some reason, as the cause of infective jaundice (Weil's Disease) a condition not uncommon in Egypt and elsewhere in tropical or sub-tropical countries. It was, however, in Germany and the United States, that the illness was found associated with the presence of this organism. It has, however, to be noted that in these cases the organism was isolated from *impure* water which had been drunk by the persons infected or in which they had bathed.

Now there is no evidence that the water in No. 6 well is in any way contaminated by excretal products. The reverse is the case, for the standard indicator of impurity *B. coli communis* has never been found in it. While there are limits to the value to be attached to the chemical and bacteriological analyses of water, still a vast amount of most reliable evidence goes to show that the absence of *B. coli* from the water is the best known criterion of safety as regards water-borne diseases. This is the view I was inclined to adopt in the present instance, but as the matter was one of great interest and importance, and as the organism has been proved pathogenic to man and was found to be highly virulent to certain rodents, I thought it well to lay the case before Dr. A. C. Houston, Director of Water Examinations to the Metropolitan Water Board, London, and probably the leading water bacteriologist of the present day. He has confirmed this view and states definitely that, although he has encountered chromogenic glucose (and sometimes lactose) fermenting microbes in well water, he does not condemn the supply, other things being satisfactory and *B. coli* being absent. Acting on this principle, which appears to me eminently sound, I have passed No. 6 well, more especially as the *B. proteus fluorescens* had disappeared from the water towards the end of the trials.

Passing now to the consideration of well No. 5 we find the problem is somewhat different. The water is clearly not derived from precisely the same source as in the case of the other wells. This is evident from its uniformly lower temperature, which no consideration of the pipe arrangements, &c., will explain. Moreover, the bacteriological content differs to some extent. The colony count was more variable and not quite so satisfactory. Chemically also there are slight, but possibly significant, differences (as shown in Dr. Beam's report). Thus, although *B. coli* has never been found in this water, the facts stated, together with the constant presence of *B. proteus fluorescens*, lead one to regard this source of supply with some suspicion. I think it would be advisable not to pass No. 5 until we have learned more about it. The water would appear to come from nearer the surface. It does not seem to have any immediate connection with the river, and as the yield is small would appear to be derived from some bed of limited extent which perhaps trends towards the surface. This is not an easy question to settle, and of equal difficulty is the determination of the source of *B. proteus fluorescens* both in well No. 5 and well No. 6. It appears that adjacent to the waterworks, there is a bed of decomposing vegetable material close to the southern river bank and about a metre under the river bed. This was encountered when the pipe trenches for the condensation water from the Blue Nile were dug, but no information was furnished me on this point, and I only learned it recently from one of the officials. Considering, however, that the cutting-off by cement is satisfactory and that the deep clay beds appear to be quite impermeable, it would not seem that any contamination could be derived from this source, and in any case such contamination might not be of a dangerous nature. The suggestion has been made that the cement used in the cutting-off process might have become contaminated from the feet of the native workpeople, and that the water-bearing beds had thus been rendered temporarily impure. If this were so, however, one would have expected a much higher colony count and a much greater variety of microbes, while some type of *B. coli* would almost certainly have been present, unless indeed other organisms, apart from *B. proteus fluorescens*, had died out in the pure deep water. This is not very likely as *B. coli* is known to be a fairly

* It seemed curious that the air blown into the water did not in any way seem to affect the colony count. At first it was carefully filtered, but afterwards this precaution was abandoned, for observations made by Mr. Williams showed that the 500 cubic ft. of free air passing per minute through the cylinders was probably subjected to a temperature of 220° F. This, though but momentary, would, I think, serve effectually to sterilize it.

† The bacillus was present as a rule in 5 c.c. and larger quantities, but was not infrequently found in 1 c c. of the water.

resistant bacillus. The organism does not appear to have come from the air-pipe line.

It would serve no purpose to discuss this matter at greater length, but there is one point on which special stress must be laid. *The results obtained can only be considered applicable to the wells under existing conditions.* True, the tests have been fairly exhaustive and severe, and personally I think it likely that the water in wells 1, 6, and 7 will continue to be a safe source of supply, but one cannot be absolutely certain, for it is possible, though not probable, that changes in the river may induce changes in the deep water. Hence the necessity for routine bacteriological tests, which, indeed, are nowadays carried out in connection with all well-conducted town supplies. These will be combined with occasional chemical examinations, and this leads one to consider carefully the report of Dr. Beam. On this occasion chemical tests are of subsidiary importance, but they possess considerable interest, and, so far as they go, they confirm the bacterioscopic analyses.

There is nothing in them to lead to a condemnation of any of the well waters. The quantities of iron and manganese present are too low to be likely to cause any trouble with Crenothrix growth, provided the large storage tank now in course of construction is in use. At the same time they are undesirable ingredients, though it will be noted that with the exception of No. 5 well they tended to diminish as pumping proceeded. It will be also noted that the plumbo-solvent power of the water was tested, although very little lead piping will be used in Khartoum.

The following conclusions, therefore, appear justifiable:—

(1) From a chemical standpoint the four wells tested, Nos, 1, 5, 6, and 7, have yielded a satisfactory supply.

(2) Bacteriologically, wells Nos. 1, 6, and 7 have yielded a satisfactory reply,

(3) Bacteriologically, well No. 5 has not proved so satisfactory as the others, and is not passed at present. As a matter of fact, I understand that as there is a low yield from this well, the Director of Works has no particular objection to its being closed, and this may possibly be done.

(4) The examinations made refer only to the water under existing conditions, though it is believed that the tests have been sufficiently prolonged and severe to make it probable that the supply will remain satisfactory as the source itself seems to be above suspicion.

(5) It will be necessary to conduct routine bacteriological examinations and occasional chemical tests, while the conditions of storage will require careful consideration.

(6) The question of quantity is one for engineers to settle, but, from the data furnished, there would appear to be an ample supply at least for the present.

I may say these conclusions have so far been amply justified. For a year and more routine tests have been made, the Nile has risen, fallen and risen again, the well water has been in general use, its quality has has remained good, and apart from a little trouble in the pipes owing to Crenothrix, the supply has been quite satisfactory. A large covered reservoir has now been constructed, and this will tend to improve matters so far as iron is concerned.

As the syllabus shows, I had intended to say something as regards distribution, storage and methods of water sterilization in the Tropics, but this paper, despite every effort at compression, has assumed alarming dimensions, and so I would again lay stress on the demonstration which has been afforded us of the great value of *B. coli*, even Houston's old, only partially qualified, elastic *B. coli*, as a standard of pollution under certain conditions in the Tropics. It would have been most interesting to apply Clemesha's tests to the *B. coli* which was found in the deep well water, but his paper had not been published, and in any case time would not have admitted of such a research. I wonder, however, into which of Clemesha's groups the *B. coli* recently found by Thresh in deep well waters in England would go! In Khartoum, Clemesha's distinctions were, for several reasons, unnecessary, but it is possible they may be of value even for deep well waters, and not only in the Tropics, although, considering the basis on which they rest, this is, at least, doubtful. In any case I trust some interest has been excited in the subject, while, apart from the vexed question of *B. coli*, I think some of the results recorded and some of the conclusions reached may be of service to those who have the responsibility of examining and reporting upon town water supplies in tropical countries.

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## WHY HAS PELLAGRA ONLY RECENTLY APPEARED IN THE UNITED STATES OF AMERICA?

NOW that the second Field Commission for the Investigation of Pellagra is at work it is interesting to notice some of the more recent expressions of opinion concerning the etiology of this disease. In 1910, just before the first Field Commission visited Italy, there appeared an article in the *New York Medical Journal*, of January 22 of that year, by Professor Howard S. Reid, in which Reid reviewed the literature as to the possible part played by a fungus or fungi in the deterioration of maize. The fungi described by French and Italian writers as affecting maize are: *Aspergillus fumigatus*, *A. flavus*, *A. flavescens*, and *Penicillium glaucus*. Dr. Wood, United States of America, reports having found penicillium, aspergillus, syncephalastrum, mucor, and chætomium in United States of America maize; but these fungi have been known in America for a long time, and mouldy corn has been used by the poorer classes in the Southern States for generations. Reid refers to an altered condition in the manner of harvesting grain which is worthy of notice, from perhaps more standpoints than that of pellagra so far as disease is concerned. Until recent years the practice of "topping" the corn stalks was followed. Topping meant not that the ear was cut off, but that for fodder purposes the green leaves above the corn ears were removed, and the ears allowed to ripen on the stalk and to become perfectly dry before gathering them. This was found to be an unprofitable practice as far as fodder is concerned, and in recent years farmers cut the entire stalk and allow the corn to mature in shocks as in the case of wheat, oat, &c. This permits the ground to be sowed with fall corn, which when it springs up does not mature and harden under these conditions, and when stored does not keep well.

This cannot, however, be said to account for the rather sudden appearance and rapid spread of pellagra in the States; and Reid is inclined to attribute the appearance to some maize-infecting organism producing toxic substances in the maize kernel. He finds that *Diplodia zeæ*, which causes an ear rot of maize, prevails in pellagra districts. This fungus was believed to exist in Carolina as long ago as 1822, but in the 1878-1900 reports diplodia is not mentioned. Of late years, however, the presence of diplodia has shown itself as causing "dry rot" in corn stalk disease to such an extent as to attract the attention of agricultural authorities, and this at a time when pellagra has appeared to rather an alarming extent. That these are related as cause and effect cannot be inferred scientifically, but that they have been so regarded is well known, for the maize theory has been accepted by the world, and it is difficult to uproot the belief or to get the matter even inquired into. The experiments in elucidation of fungi-infected maize being the cause of a disease in animals is stated by Reid as follows: "Diplodia meal was obtained by inoculating sterilized maize meal with *D. zeæ* taken from pure culture. After several weeks, when the meal was thoroughly permeated with mycelium and some spores, this was fed to four healthy mice on October 23. No positive effects were noticed at first, but on the fifth day three of the mice died. The surviving mouse was sluggish, indisposed to use the fore limbs, and at intervals overcome with tremors. The fore limbs appeared to be somewhat paralyzed. When wheat was placed before the mouse, it was eaten and the mouse appeared to recover. When the wheat was gone the mouse again ate the diplodia meal and died six days after the other mice had died."

This experiment merely proved that maize infected with diplodia cultures made the mice ill.

In his summary of the evil effects of diplodia on maize and of rendering maize thereby a disease-causing food, Reid states that:—

Fungi belonging to the genus diplodia grow both parasitically and saprophytically upon maize and are at present known to occur over a large part of the maize-producing territory in the United States, especially in portions in which pellagra, or pellagrous diseases, have also appeared. These fungi, which appear to have become widely distributed more or less simultaneously with the appearance of numerous cases of pellagra, seem, on account of these facts, fully as probable of significance in the ætiology of this disease as those fungi which have for years been associated with mouldy maize.

The maize upon which diplodia has grown is altered both in physical and chemical composition. Meal infected with diplodia was found toxic to mice.

The isolation of alcohol soluble proteins from diplodia meal yields compounds differing from the bodies isolated by the same means from sterile meal. The products obtained from diplodia meal appear to resemble in every way the pellagrozein isolated and described by Lombroso.

It is well, in view of the possible conclusions arrived at by the Pellagra Field Commission now at work in Austria-Hungary and in Spain, to have the damaged maize theory before us, for although it may not be true we have had no other presented to us in anything like a systematic form until Dr. Sambon advanced the parasitic theory of the disease. His evidence in this direction amounts at present to epidemiological evidence merely; not that this evidence is not important—nay, it may be conclusive—but present day beliefs based upon epidemiology alone does not find favour.

### "Sleeping Sickness Bulletin," No. 29, 1911, vol. iii.

*Sleeping Sickness.*—The above number of the Sleeping Sickness Bulletin contains the following papers. (1) Transmission of trypanosomes. (2) Diagnosis of human trypanosomiasis. (3) Duration of trypanosome infections. (4) The human trypanosomiasis of Brazil. (5) Chemotherapeutical studies. (6) Treatment of trypanosome infections. (7) Studies on immunity. (8) Trypanosomes without blepharoplasts. (9) The toxin of *B. subtilis* and its relation to trypanosomes. (10) Trypanosomes demonstrated by the cultural method. (11) Trypanosomes of animals. (12) Sleeping Sickness News and Monthly List of References.

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# Tropical Medicine and Hygiene

OCTOBER 2, 1911.


## FIVE TO SEVEN IN THE TROPICS—THE PRE-DINNER PERIOD AND ITS DANGERS.

IN warm climates the monotony of the daily routine of life is apt to engender habits, customs and a frame of mind calculated to enthral initiative, to warp the energies, and to reduce the resident to a machine-like constancy of habit which tends to depression of spirits and loss of desire to break away from long-established custom. If these habits are good it would seem that there is no occasion to disturb the routine, but, if unwise, then the evil is pronounced.

What suits one temperament may be, and often is, deleterious to another, and the habits suitable to older persons may not only be unsuitable, but deleterious to younger folks.

Perhaps the most difficult period of the twenty-four hours to adjust to healthy hygienic conditions are the hours between 5 and 7 or 8 o'clock, that is the interval between the time the day's work is usually over, namely 5 p.m., and the dinner hour. The different ways of spending this period of the day may be grouped under two headings—rest and exercise.

The man, who from 9 a.m. to 5 p.m. stands or sits at a desk, engaged in the ordinary work of a merchant's office or of a bank, in a warm climate with a punkah over him to keep him cool and with his attention focussed on figures, may feel so exhausted that exercise is out of the question owing both to mental and bodily fatigue. He seeks a couch to rest himself upon immediately the office is closed, and reads, rests or sleeps until it is time for dinner. He may, and the majority of people do, find that a stimulant is comforting, and after a time habit makes it a necessity. On the other hand many men take exercise after office hours; the older man may be content with a walk, or may play golf or ride on horseback. The younger men may find exercise in polo, tennis, racquets, or cricket. The men who take exercise do best no doubt, but the exercise produces thirst, and the thirst is relieved by alcohol as a rule diluted, of course, with aerated water. Whether resting or taking exercise, therefore, between 5 and 7 p.m., alcohol plays a part, often a prominent part, in the day's régime, and it is the period of the day that exercises the doctor's mind more than any other, when men come to consult him as to their diet, &c.

Physiologically considered the problem is difficult. A hard day's work at the desk or the warehouse in a tropical country produces a feeling of tiredness akin to exhaustion. What is the best plan of dealing with it? Is exercise the best remedy? Is it right to tax further the jaded state by muscular exertion in the open air? It may be argued that indoor work must be met by exercising a different set of muscles at tennis, cricket, golf, &c., when the fatigue is thrown off and the stimulus of exercise benefits the whole frame. No doubt this is sound in a measure and as a rule, and for the younger men it is to be encouraged; but in older men the energy may be lacking, and it is a question whether their tiredness is to be discounted and exercise advised. If advised, the next question is how are they to be encouraged and stimulated. Is alcohol to be prescribed before the walk or ride, or deferred until they come in; or is it wise to allow any at all, and, if so, what stimulant?

Our greatest soldier and most ardent campaigner, who is still with us, after the day's work in India was over and before the dinner hour was due took champagne as a restorative. It was the only stimulant he took, and at no other period of the day did he partake of any other; not at or after dinner, but between the hours of 5 and 7 p.m. That it did good would seem incontestible when one knows the amount of mental and physical work which he so frequently did, and the thoroughness and completeness with which it was accomplished. Is this a safe rule to follow, and is champagne the best form of stimulant to take? The amount of alcohol in champagne is small, rendering it little more than a teetotal drink, but the form in which the alcohol is exhibited has a stimulating and recuperative effect out of proportion to the amount

of alcohol champagne contains. The kind of champagne no doubt has a bearing on the point, but it is a useless fight to persuade even doctors that dry champagne is not the best. Dr. George Harley, in his well-known book on the liver, showed up the deleterious nature of dry champagne, but his words fell on deaf ears, and not only the public but medical men still believe that the drier the wine the better. Dr. Harley asks the doctor to once put his blue test paper into a glass of dry champagne and gauge the acidity, and he states that unless the doctor is inconvincible or a fool he will never prescribe dry champagne again. The acid added to make the wine dry "to suit English tastes" is pure hydrochloric acid or other acid. The effect of pouring hydrochloric or any other strong acid into an empty stomach the doctor well knows, and without discussing the matter further I would refer him to Dr. Harley's discussion of the subject, when he will no doubt become convinced that "champagne," and not the *sec* and *extra sec* adulterations, is the wine he will in future recommend. But all men cannot afford champagne; what, then, is the next best stimulant to be employed? Tea is a stimulant, but it is slow in its action; when, however, one or two teaspoonfuls (neither more nor less) of whisky is added to the tea an excellent safe and palatable stimulant is to hand. The whisky and soda, or more often the several whiskies and sodas, taken between 5 and 7 are deleterious to a degree. They are said to give an appetite, but they do so by creating a state of catarrh of the stomach, which being relievable by food separating the raw surfaces of the stomach and preventing them rubbing up against each other, may well be pronounced the "false appetite" that one hears of in popular language.

Space will not allow of this subject being dealt with further at present, but we would welcome discussion on a point which is of vital importance to the digestion and to the welfare of those working in hot climates.

J. C.

Volume V. of the *Annals of Tropical Medicine and Parasitology*, August 1, 1911 (Series T. M., Vol. V., No. 2), contains the following papers: "Notes on Tropical Diseases in Southern Italy," by Professor Umberto Gabbi; "The Papataci flies (*Phlebotomus*) of the Maltese Islands," by R. Newstead; "The Experimental Transmission of Goitre from Man to Animals," by Robert McCarrison; "Reducing action of Trypanosomes on Hæmoglobin," by Ralph W. Nauss and Warrington Yorke; "The Anti-Malaria Operations at Ismailia," by J. W. W. Stephens; "On some new Species of African Mosquitoes (*Culicidæ*)," by Robert Newstead and Henry F. Carter; "The Diagnosis and Distribution of Human Trypanosomiasis in the Colony and Protectorate of the Gambia," by John L. Todd and S. B. Wolbach; "The Mechanism of the Production of Suppression of Urine in Blackwater Fever," by Warrington Yorke and Ralph W. Nauss; "On the Relation of the Organic Phosphorus Content of various Diets to Diseases of Nutrition, particularly Beri-Beri," by G. C. E. Simpson and E. S. Edie.

## Annotations.

*Malaria in the Punjab.*—The "Scientific Memoirs," No 46, contains a monograph by Major S. R. Christophers, M.B., I.S.M., 1911, on "Malaria in the Punjab." Malaria is regarded usually as a disease to be dreaded, not so much as a disease that kills, as one that incapacitates merely. This belief was rudely shattered by the history of the recent outbreak in the Punjab and United Provinces, where malaria rivalled a virulent epidemic of plague in its mortality. In the Punjab alone during October and November, 1908, the deaths from malaria numbered 307,316. Major Christophers has dealt with the 1908 outbreak in a form which commands attention. His report is handled with a scientific acumen, of which but few men in our profession are capable, and must remain as a monument of patient work and a model for others to aspire to.

The Punjab has always been known as a malarial district. The seasonal character of the disease has been marked, and the explanation has been found in the fact that the breeding period of anopheles and the appearance of malaria coincide. One of the most interesting chapters is that devoted to epidemic and and endemic malaria. Malaria in an endemic form is a "normal" feature of the Punjab, and it might be expected that the prevalence of malaria would produce an immunity to the disease; but so far from this being the case, it is reported that in Amritsar, the portions of the city most severely attacked by epidemic malaria are those most subject to endemic malaria. In Delhi the same fact is noted, and even in villages in which malaria is always present, the outbreaks behaved there also in epidemic form attended by a high mortality.

The determining causes of epidemic autumnal malaria seem to group themselves under two headings, namely, rainfall and scarcity of food: and "just as in famines, malaria cannot act until Nature is about to bring them to an end, so there can be little doubt that the effects of scarcity are to a large extent held over until the appearance of the first heavy monsoon. Then, though the effect of the rain is to reap a harvest of death the period of stress is brought to an end."

As regards means of prophylaxis of malaria in the Punjab, the chief method to be advised is immediate removal, or prevention of flood water, for the high degree of epidemic intensity would seem to be almost, if not entirely, a matter of villages being flooded. "If, as seems to be the case, severe epidemic malaria follows flooding, the most energetic anti-mosquito campaign can influence but little the vast mortality which may occur in any year in almost any district. That under these circumstances, until drainage can be instituted, the use of quinine as a prophylactic and as a means of saving the life of actual sufferers must be pushed to the utmost is self evident.

*Summary of Conclusions.*

Briefly recapitulating the facts recorded in the earlier parts of the paper, Christophers summarizes the results of his observations as follows:—

(1) Malaria in the Punjab is manifested in two ways, namely, as "endemic malaria," and as "autumnal epidemic" or "fulminant malaria."

(2) Economically the latter is by far the most important, and it is the effects of this form which are usually referred to when the disastrous results of malaria in the Punjab are spoken of.

(3) The epidemic of 1908 was of this character, and there have been similar and almost if not quite as severe epidemics at intervals at least as far back as the sixties.

(4) These epidemics are focal, that is, their effects are greatest in the centre of the epidemic area and fade towards the periphery. Their distribution vividly calls to mind such phenomena as areas of low or high barometric pressure, and not at all that of a disease following lines of communication, or even local peculiarities of the ground.

(5) The history of past epidemics shows that they affect all parts of the submontane tract, but have shown a special frequency over certain areas. In 1908 there existed for the first time two distinct major epidemic areas, the southern one producing epidemic effects, also over the western half of the United Provinces.

(6) Epidemic malaria attacks most severely those communities which already show a high degree of endemic malaria. It is therefore not merely the result of malaria attacking those unaccustomed to the disease, nor are endemic areas in any way protected against it.

(7) The most salient feature of the epidemic condition is the excessive mortality and its conspicuously infantile character.

(8) The condition of a population in the Punjab as regards natural increase or decrease is influenced rather by the number and severity of the epidemics to which it has been exposed than by its endemic malaria. Even the effects of famine are mainly shown through the effects of the epidemic malaria which follows them.

(9) Town and cities suffer equally with, even in some cases more than, rural areas, and even the centre of the large cities, Amritsar and Delhi, are only moderately protected from epidemic effect.

(10) The determining causes of epidemics are excessive rainfall and scarcity; the former is an essential whilst the latter is an almost equally powerful influencing factor. Owing to the meteorological cycles there is a tendency for epidemics to occur at the point where the first heavy monsoon appears after a succession of years of deficient rainfall.

(11) The epidemic areas are not necessarily or even usually coincident with that of the heaviest rainfall nor that receiving the greatest increase over the normal rainfall. Any marked relation to "interval" between the falls, &c., is not suggested by a study of the rainfall figures. The whole facts are only explicable when flooding is taken into account.

(12) When epidemic areas are examined in detail the villages are found to have suffered almost exactly in proportion as they have been flooded. Floods act equally, whether they are due to local rain or to the indirect effects of rain causing the overflow of rivers. The higher epidemic figures seem to depend entirely upon floods and *fulminant malaria of a certain intensity is almost synonymous with malaria of diluvial origin.* The relation to flooding explains why epidemic areas are not exactly coincident with the areas of heaviest rainfall, and why the former almost always overlaps the latter in the direction of the line of drainage.

In the case of lower epidemic rates the *thana* figures may be influenced in two ways:—

(i.) By the number of villages showing "fulminant" malaria.

(ii.) By the number of villages showing a moderate raising of the mortality.

Whilst the very severe manifestations of fulminant malaria seem to be dependent on floods, epidemic malaria seems to reach a certain intensity apart from floods in the sense we are now using this term. But the conditions at Mian Mir and other observations suggest that even here something very like flooding occurs in so far as extensive sheets of water are formed.

(13) The exact mechanism of epidemic causation is still unknown. But the epidemic condition appears to be due to an excessive seasonal increase of the normal parasite rate, fluctuations in which occur even in healthy years.

Malarial infections must be studied quantitatively. An endemic index of 100 per cent. may be represented in one case by a community containing only a few parasites in their blood and living in a condition of comparative health, in another case the index may refer to a community heavily infected and prostrated by fever.

In the Punjab one frequently hears matters discussed as if the population was uninfected and remained so until the fever season came round, when any individual was more or less liable to catch infection. It is nearer the truth to say that we have a population already infected and that what happens in the fever season is the "hastening up" of this infection.

(14) Experiments on sparrows and proteosoma show that severity of infection is largely dependent on the dose inoculated. This is not merely a matter of the number of infected mosquitoes but of the number of sporozoites injected at each bite. This in turn depends upon the number of gametes in the blood of the original sparrow by which the mosquito was infected. Under experimental conditions the latter was the most important factor and it was easy to see as a result of dissection that one heavily infected mosquito might inject more sporozoites than a hundred that were only scantily infected.

No observations exist as to the conditions in regard to anopheles at epidemic times, but the close association of fulminant malaria with actual flooding suggests something more than the ordinary reproduction of the genus in pools, &c. The matter is the most urgent still awaiting elucidation.

(15) Physical features influence epidemics and low water-logged areas are especially susceptible to epi-

demic conditions. Higher tracts, on the contrary, are comparatively less susceptible. But these differences are often lost when a district becomes involved in the nucleus of an epidemic area.

(16) The great canal systems have no distinct influence upon malaria of this kind, though it is possible that neglected canal irrigation with extensive local floodings may have had very serious effects in the past.

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*The Pathogeny of Ulcerating Granuloma.*—Dr. C. L. Strangman, in the *Australian Medical Gazette* of February 20, 1911, writing from Port Darwin, Northern Territory of Australia, described a round-cell infection by certain organisms of "boomerang" or half-moon shape, and others that showed polar staining; also some changes noted in their development on artificial media from "incomplete spindle" to club formation. He also noted that, organisms taking the shape and form of spirilla of the various types, spirochætæ, yeast-like spores of varying size, strepto- and staphylococci, motile organisms, flagellates, and botryomyces, had been met with in one lesion.

In a subsequent publication, in August 21, 1911, of the same gazette, Dr. Strangman states that it can now be proved that most, if not all, of these organisms occupy a vital and necessary place in the cycles of development of a polymorphous fungus, allied to the actinomyces. Two distinct cycles of development were partly followed; in one (*a*) the organisms were Gram positive in every stage; in the other (*b*) Gram negative. When grown separately, certain stages were reached and the organism died out without further dissolution of the medium, but when grown together not only was the whole medium liquefied but there were evidences of a sexual phase, followed by the production of branching filaments, and later on the formation of mycelial nodules, in which two distinct varieties of sporangia or spores were formed.

"Previous to my report, on every attempt at plating, I found colonies of organisms that appeared definitely to be staphylococci. Consequently they were not further considered, and frequent subculture from different parts of the media was relied upon to obtain purer strains. Pure cultures have now been isolated, and the results attained have necessarily modified some of the stages of development previously described."

Dr. Strangman states "that there is no lack of material in the Northern Territory for the study of this disease, and since I first noticed the regularity with which half-moon bodies, incomplete spindles, and polar staining cells were in evidence in every active lesion, I have examined pus films from the discharge from sores of 92 consecutive cases—both white and coloured—and in every one I have found an infection with the organism described in one or more of its stages."

Although direct inoculation experiments have not been tried the presence of giant cells surrounding the infected round cells in *active* lesions with a double infection, the disc-like caseation that was noted in sections and at the periphery of the cultured fungus, the fact that every form observed in each stage of development in the test-tube can, when suitably stained, be seen in the discharges from open lesions, and the universal presence of the parasite in one or other of its forms in every consecutive case of the disease, cannot but lead to the belief that the causative parasite has been isolated.

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*Dengue-like Fevers.*—In the *Indian Medical Gazette*, of September, 1911, Lieutenant A. Campbell Monro, I.M.S., discusses the probability of dengue, seven-day fever, phlebotomus fever of the Mediterranean coast and three-day fever, the sand-fly fever of Northern India being akin, and submits that there is a *prima facie* case for the consideration of these pyrexias as a single disease, and that the generic term dengue covers the group. He draws attention to the variability of type which dengue presents. The general type of cases in one epidemic may differ very widely from the type in another; as instances of epidemics that differed very considerably in their clinical type, one may cite the Indian epidemic of 1871-3, the Brisbane epidemic of 1905, and the Fort McKinlay (Philippines) epidemic of 1906. Within a single epidemic, too, there is wide variation among the individual cases. Ashburn and Craig say: "There is no symptom that can be said to be pathognomonic or even constant, if we except fever," and this feature of the disease is emphasized in most modern text-books.

Again, in seven-day fever, although there are some minor differences recorded these seem to furnish a sound basis of diagnosis whereby dengue and seven-day fever can be clinically separated. Lieutenant Monro states that the mode of onset, the puffy appearance of the face, the injected suffused eyes, the general appearance and condition of the patient, the characters of the first and second rashes, the temperature curve, the bradycardia, the severe pain in the small of the back, the less constant pain in the limbs, the frontal and orbital headaches, the gastric symptoms, the character of the tongue, the leucopenia, the probable incubation period, the seasonal incidence—all are identical in the two diseases.

Descriptions of phlebotomus fever and dengue in their clinical picture seem to coincide, and the one outstanding difference would appear to be that a secondary paroxysm is rare and a secondary rash consequently absent. It should be observed, however, that secondary fever occurred in the same month as phlebotomus fever in the latest Egyptian epidemic, and Doerr states that in phlebotomus fever cases in Austria, relapses may occur apart from fresh infection. It seems also that the three-day fever (the sand-fly fever) of Northern India is regarded by many observers as the same disease as that known as phlebotomus fever; double paroxysms occurring in both fevers. Lieutenant Monro concludes by saying that the burden of proof rests with those who would recognize these pyrexias as being distinct and separate entities, and holds that unless and until more than

one causal organism are isolated, all these fevers should be inducted under the one name "dengue."

*Burdwan Fever.*—Dr. W. N. Brahmuchuri, in the *Indian Medical Gazette*, September, 1911, discusses the nature of the epidemic fever in lower Bengal, commonly known as Burdwan fever. Opinions of the nature of this great epidemic, which was first reported about 1854, changed Burdwan from being a neighbourhood regarded as a health resort, to one of deadly sickness. Some regarded the disease as typhus, others as typhomalaria. Greene thought it was typhoid, whilst Major Rogers considers it was kala-azar. Dr. Brahmuchuri considers that two diseases prevailed and were imported together, namely malaria and kala-azar. The characteristics of the sequelæ were described by Roy as follow :—

"The first and most frequent in order is enlargement of the spleen. It varies considerably in size, from being just perceptible under the costal cartilages to filling up the whole abdomen. From a distance the pot-bellied feature with distended veins on the surface of the abdomen gives an appearance of dropsy. There may be enlargement of the liver. There may be obstruction to the portal circulation ending in ascites. There may be large prominent veins on the surface of the abdomen. Dropsy is the sequela with which these cases take a fatal turn.

"The lean, emaciated limbs and haggard countenance seen on a bloated trunk gives a most unsightly appearance. Unless timely treated with tonics and nourishment, cancrum oris makes its appearance and puts an end to the patient's miserable existence. It is frequently accompanied with dysentery. There is a watery state of the blood, and there may be hæmorrhagic diathesis. Bleeding from the nose and gums is a very common complication. There may be bleeding from the mouth or rectum."

Whatever was the case in Burdwan before 1854, ever since the appearance of the great epidemic the district of Burdwan has been notorious for malaria.

*The Etiology of Beri-beri.* — Chamberlain and Vedder, in a contribution to the etiology of beri-beri, published in the *Philippine Journal of Science*, for June, 1911 (vol. vi., No. 3) state that they have repeated the work done by Fraser and Stanton on polyneuritis in fowls, and have been able to confirm their results. The authors finally conclude that: (1) polyneuritis gallinarum is not prevented by adding to a diet of polished rice any of the following substances: potassium phosphate, potassium citrate, potassium carbonate, potassium chloride, magnesium phosphate, phytin, phosphoric acid, or phosphoric acid combined with potassium chloride; (2) the neuritis-preventing substance in rice polishings is soluble in cold water and in cold alcohol; (3) polyneuritis gallinarum may be prevented by means of an extract of rice polishings containing only those substances soluble in cold water and cold alcohol. This extract, so far as at present known, has the following composition :—

| | | |
|---|---|---|
| Total solids .. .. .. | 1·34 | per cent. |
| Ash .. .. .. .. | 0·03 | ,, |
| Phosphorus pentoxide .. | 0·00165 | ,, |
| Nitrogen .. .. .. | 0·0406 | ,, |
| Sucrose .. .. .. | 0·88 | ,, |

(4) Multiple neuritis in fowls fed on polished rice probably is not due to lack of phosphorus compounds in the grain, as claimed by Schaumann, since out of each 1,000 parts of phosphorus contained in the rice polishings, at least 999 are not concerned in preventing neuritis; (5) the neuritis-preventing substance contained in rice polishings is capable of dialysis through a parchment membrane. This excludes all colloids from consideration. Though the above conclusions are based on a small series of experiments, yet the authors believe that the results appear so conclusive and are so far-reaching in their importance that it is desirable to report them at once. They are now conducting further experiments to confirm the above observations, and also to determine the effect on fowls of the remaining untried substances contained in the extract mentioned above, especially of the sucrose which constitutes much the larger part of the total solids.

*Kala Azar.*—Christophers, writing on an investigation into the prevalence of kala-azar in Upper Assam, in "Paludism," No. iii., July, 1911, states that considerable difficulty was felt in arriving at a diagnosis in what may have been sporadic cases of kala-azar. He considers that, on the whole, experience gained by splenic puncture shows that the following types of very large spleens may be distinguished.

(1) Large spleens yielding Leishmania on puncture.

(2) Large spleens in which no parasites are found even when many splenic cells are included in the blood drawn from the spleen. Nevertheless, not infrequently in these cases the history and clinical evidence very strongly suggest kala-azar. It is possible, Christophers believes, that at certain stages of the disease parasites are greatly reduced in numbers, or that they are absent from portions of the spleen.

(3) Very large spleens exactly resembling Leishmania spleens, but there is usually a very long history, and the patient, though he may be anæmic, is well nourished, and may even be robust. The frequency of this condition among the immigrant coolie population from certain localities, *e.g.*, Arrah, is very notable. A very similar condition is common in the Punjab, and is drawn attention to by Ferguson and Day in Egypt.

(4) Very large spleens associated with marked anæmia, and often with a considerable amount of œdema of the face and ascites. To superficial examination these cases often simulate kala-azar very closely, but on puncture they yield only malaria parasites.

## Personal Notes.

COLONIAL MEDICAL SERVICE.

Dr. P. Howard Hennessy, Medical Officer, Straits Settlements, has been transferred to the Federated Malay States as a Medical Officer, Grade II.

## Notes and News.

AN Editorial note in vol. i., No. 3, of "Paludism"—the transactions of the Committee for the study of malaria in India—states that in the last week of January, 1911, one of the members of its Committee had an opportunity of placing on record the view that the progress of public health in India might be greatly advanced by the establishment of a special fund to be devoted to research in connection with sanitation. The idea met with the approval of the Government of India and a sum of five lakhs of rupees was set aside as an *Indian Research Fund*.

It has been decided that the primary object of the fund will be to assist the policy which for some years has been followed in India of making a direct attack upon certain of the more important epidemic diseases. Research is the starting point and basis of this policy, for it has been shown not only in other countries, but in India, that when the actual sources and modes of conveyance of infection have been exactly ascertained, the measures which can be adopted are often far more simple and are always incomparably more effective than those recommended in the absence of this detailed knowledge. The organization proposed for carrying out the objects of the Fund is an Association consisting of permanent and temporary members, the control and management being vested in a Governing Body, of which certain members will be appointed to act as a Scientific Advisory Board through which proposals in connection with the scientific objects of the Association will be submitted. The proposals approved by the Governing Body will be carried into effect with the aid of the Working Committees, of which the Central Committee for the study of malaria will be one. It is hoped also to form committees to organize and carry on study in regard to (1) medical entomology; (2) vital statistics and the more general problems of disease; (3) cholera; (4) plague; (5) problems of practical sanitation, and especially the model towns and other measures by which the efficacy of sanitation is demonstrated to the public.

THE Seventh International Congress against Tuberculosis will be held in Rome from April 14 to 20, 1912.

## Obituary.

THE Central Committee for the Study of Malaria in India record with profound regret the death, on March 27, 1911, of their late President, Lieutenant-Colonel J. T. W. Leslie, C.I.E., I.M.S.* For more than fourteen years Lieutenant-Colonel Leslie, first as Secretary to the Sanitary Commissioner with the Government of India, afterwards as Sanitary Commissioner, laboured with untiring zeal and industry to advance the cause of public health in this country. He was a man in whom the qualifications of great administrative ability, sound judgment and unrivalled knowledge of the sanitary needs of India were combined with technical attainments of a high order and a wide scientific outlook. He always held that research is the foundation of sanitary progress and in this connection the Bacteriological Department, the Organization for the Study of Malaria, and the Indian Research Fund are examples of the fruits of his labours. He possessed remarkable powers of critical analysis and of realizing at once the true significance of problems and results: and although his official duties were arduous he always found time to keep abreast of the most recent scientific work. During the periods of his leave to Europe it was his practice to study in one or other of the continental laboratories, and he was intimately acquainted with the work and writings of German and French specialists. His interest in protozoology led him, when he was last on leave in Germany, to undertake and almost complete the serious task of translating into English Professor Doflein's unique treatise on that subject, Men of affairs sought his advice, and no research worker ever consulted him without obtaining valuable suggestions and that sympathetic and keenly interested encouragement which is an enduring stimulus to continued effort. His untimely death is a loss not only to India which he served so faithfully and well, but to the world of scientists to whom at heart he belonged.

* From "Paludism," being the Transactions of the Committee for the Study of Malaria in India." Edited by S. P. James and S. R. Christophers. No. 3. July, 1911. Simla, Government Central Branch Press. 1911.

### EXCHANGES.

American Journal of Surgery. Annali di Medicina Navale. Annal d' Igiene Sperimentale. Archiv für Schiffs u. Tropen-Hygiene. Archives de Médecine Navale. Archives de Parasitologie. Archives of Internal Medicine. Archives Russes de Pathologie, de Médec. Australasian Medical Gazette. Boletin de Medicina Naval. Boston Medical and Surgical Journal. Bristol Medico-Chirurgical Journal. British and Colonial Druggist. British Journal of Dermatology. British Medical Journal. Brooklyn Medical Journal. Bulletin Médical de l'Indo-Chine Française. Caducée. Clinical Journal. Clinique et de Bacteriologie. Gazetta Internazionale di Medicina, Chirurgia, Igiene. Giornale Medico del R. Esercito. Hong Kong Telegraph. Il Policlinico. Indian Medical Gazette. Indian Medical Record. Indian Public Health. Interstate Medical Journal. Jahresbericht. Janus. Journal of the Royal Army Medical Corps. Journal of Laryngology and Otology. Journal of the American Medical Association. Journal of Experimental Medicine. Journal of Tropical Veterinary Science. La Grèce Médicale. Lancet. Liverpool Medico-Chirurgical Journal. London and China Express. Medical Brief. Medical Missionary Journal. Medical Record. Medical Review. Merck's Archives. New York Medical Journal. New York Post-Graduate. Pacific Medical Journal. Philippine Journal of Science. Polyclinic. Revista de Medicina Tropical. Revista Medica de S. Paulo. Sei-i-Kwai Medical Journal. The Hospital. The Northumberland and Durham Medical Journal. Transactions of the American Microscopical Society. West India Committee Circular, West Africa. New York State Journal of Medicine.

## Notices to Correspondents.

1.—Manuscripts sent in cannot be returned.

2.—As our contributors are for the most part resident abroad, proofs will not be submitted to those dwelling outside the United Kingdom, unless specially desired and arranged for.

3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.

4.—Authors desiring reprints of their communications to the JOURNAL OF TROPICAL MEDICINE AND HYGIENE should communicate with the Publishers.

5.—Correspondents should look for replies under the heading "Answers to Correspondents."

## Original Communications.

# A THIRD REPORT ON EXPERIMENTAL WORK ON ANIMAL TRYPANOSOMIASIS.

*Conducted at Ibi, in Muri Province, Northern Nigeria, from January to October, 1910.*

By H. Andrew Foy, D.P.H.,
*Junior Sanitary Officer, West African Medical Staff.*

INDEX OF SUBJECT.

(1) Reports I. and II.—(2) Report III.—(3) Town of Ibi.—(4) Presence of tsetse-flies at Ibi.—(5) Blood-sucking flies caught at Ibi.—(6) Normal temperatures of animals —(7) Temperature charts.—(8) Incubation periods in animals.—(9) Invasion of the disease.—(10) Animals previously experimented on: horse D, calf M, Horse F, calf K.—(11) Controls sent from Maifoni.—(12) Other animals used in experimental work at Ibi.—(13) Observations and experiments made at Ibi on the animals which came from Maifoni in January, 1910: horse D, conclusions based on horse D, horse F, calf M, calf K, conclusions based on calf K, calf 1 and calf 2; controls from Maifoni: horse 1, calves 1 and 2, calf 3.—(14) Experiments conducted at Ibi: I. Experiments in treatment: (*a*) by intravenous injections of perchloride of mercury, horse 3, horse 4; (*b*) by intravenous injections of methylene blue and then perchloride of mercury, horse 5, horse 6; (*c*) by the Fagan treatment, horse 4, horse 6, horse 7, horse 8; (*d*) by arsenic, horse 5; (*e*) by soamin, horse D; conclusions as to results of treatment: II. experiments in immunity: (*a*) immunization of a horse by injection of blood from a horse that had recovered after treatment, horse 1; (*b*) immunization of calves by injections of blood and serum from a calf that had recovered from a mild attack of the disease produced by the inoculation of an attenuated strain; (*c*) immunization of calves by the injection of blood and serum from a bull that apparently possessed natural immunity, Pagan bull No. 4, calf 5, calf 3, calf 6; results obtained in immunity experiments.—(15) General summary of results and observations: I. primary remarks; II. treatment results in horses and cattle; III. immunity results in the horse and in cattle; IV. other observations.—(16) Conclusion.

(1) *Report I* on the results obtained in the treatment of experimental trypanosomiasis in animals was submitted to Government in January, 1908, after the work had been continued for three months, viz.: October, November, and December, 1907, at Maifoni, S. Bornu.

*Report II*, on experimental work on animal trypanosomiasis, conducted at Maifoni, South Bornu, from January to October, 1908, was submitted to Government in August, 1909, on my return from leave to the Protectorate. The summary of results given in this report included results mentioned in Report I.

The above-mentioned reports were on work conducted at Maifoni, South Bornu, where no tsetse-flies existed and where animal trypanosomiasis was not known to exist naturally except for imported cases or cases that arrived infected after passing through a fly belt.

(2) *Report III*, now under consideration, covers results obtained in experimental work on animal trypanosomiasis conducted at Ibi, in the Muri Province, for ten months from January to October, 1910, when I was stationed as medical officer there.

(3) *The Town of Ibi* is situated on the south bank of the River Benue, in the Muri Province. The official quarters are situated on a ridge running parallel to the river and the experimental work was conducted on this ridge.

(4) *Presence of Tsetse-flies at Ibi.*—Tsetse-flies first made their appearance on May 15, with the onset of the wet season and were prevalent up to the month of November, when the rains gave over. With the receding of moisture and the parching of vegetation, the flies receded also to the low-lying, moist vicinity, until later they could only be found in areas where moisture and vegetation were permanent, such as marshes and streams flowing into the River Benue.

(5) *Blood-sucking Flies caught at Ibi.*—The following list of blood-sucking flies, caught at Ibi, and sent to Mr. Austen, of the British Museum (Natural History), London, for identification, was furnished by him:—

Family Tabanidæ: *Tabanus fasciatus*, Fabr.; sp. nov.; *T. talipes*, Macq.; *T. biguttatus*, Wied.; *T.* form *croceus*, Surcouf; *T. par*, Walk.; *T. tæniola*, Pal de Beaurt; *T. ditæniatus*, Macq.

Family Muscidæ: *Glossina tachinoides*, Westw.; *G. palpalis*, form intermediate between typical *G. palpalis*, Rob. Desv., and *G. palpalis Wellmani*, Austen.

*Glossina palpalis* formed about 3 per cent. of all the tsetse-flies caught by me at Ibi.

(6) *Normal Temperatures of Animals* struck from observations made during previous experimental work: (*a*) Horses, 98° to 100° F. (*b*) Oxen and calves, 97° to 102.6° F. (*c*) Dogs, 97° to 102.4° F. (*d*) Monkeys, 97° to 102° F.

(7) *Temperature Charts.*—A register of the morning and evening temperatures of each of the animals under experiment at Ibi was systematically kept, but the charts are not submitted as it is considered unnecessary.

(8) *Incubation Periods.*—The following periods of incubation of experimental trypanosomiasis after inoculation have been struck from observations made in the course of experimental work: (1) Horses, 3 to 14 days; (2) calves, 4 to 13 days; (3) dogs, 8 to 12 days.

(9) *Invasion of the Disease.*—This is marked by a rise of temperature which takes the form of either a sudden sharp rise with a concurrent invasion of the blood-stream by trypanosomes or by a rise of temperature starting a couple of days after inoculation, the temperature gradually rising higher every afternoon and at some stage of this gradual rise of temperature the blood on examination will show the presence of trypanosomes.

In the case of horses in which the invasion is marked by a sudden rise of temperature to a great height the animal looks ill, there is extreme depression, the head droops, the breathing is much accelerated, and a thin amber-coloured discharge runs from the eyes and nostrils. In the case of calves and dogs this form of invasion by sudden onset with high temperature and extreme depression is not usual.

(10) *Animals previously experimented on at Maifoni.*—The following animals that were experimented on at Maifoni, in South Bornu, particulars

of which were fully given in Report II, submitted in August, 1909, were brought overland from Maifoni to Ibi, a journey of five weeks, with the object of further observation and experiment: Horse D, (a bay), horse F (a chestnut), calf K (a black), calf M (a black and white).

It will be as well to review briefly a few of the details concerning the experimental work on these animals and the results as submitted in Report II, which covered work done up to October, 1908, when I proceeded on leave to England. During my period of leave these animals which survived were left at Maifoni in charge of Dr. Alexander, the Medical Officer who relieved me, and later they were in charge of Dr. Moiser, Medical Officer, who subsequently in December, 1909, under instructions from the Principal Medical Officer, Zungeru, sent them to Ibi, together with a certain number of animals as controls.

These animals had now survived a period of fifteen months after the experimental work on them had ceased in October, 1908, until they again came under my observation in January, 1910, at Ibi.

*Horse D.*—This horse was first inoculated with trypanosomiasis in February, 1908. He developed the disease and was treated first by intravenous injections of methylene blue, which failed to have any curative effect, and subsequently by intravenous injections of perchloride of mercury, which had the following effects: (1) A fall in temperature; (2) removal of trypanosomes from the blood. Later there occurred: (1) Relapses both of temperature and trypanosomes; (2) loss in condition, especially if subjected to long marches and fatigue, with subsequent improvement; (3) finally, the temperature ran practically normal and no trypanosomes could be found in the blood.

After the animal had been treated and showed signs of recovery he was put to use and subjected to three long marches of twelve days, thirty-two days and thirty-two days respectively, which he stood fairly well; his condition fell off, but this he regained by adequate rest and diet. After treatment in May, 1908, when his temperature was running normal and his blood was free from trypanosomes, a certain quantity of blood was drawn from his jugular vein, allowed to coagulate, and 30 c.c. of the serum injected subcutaneously into calf M, with a view to trying to confer artificial immunity; and 50 c.c. into horse 1.

*Calf M* was, in May, 1908, injected subcutaneously with 30 c.c. serum, obtained from the blood of horse D, and at the same time 50 c.c. serum was injected into horse 1. The blood serum apparently contained trypanosomes, for it proved infective and fatal to horse 1, but the strain of trypanosome in horse D seems to have been lowered towards calf M, as a result of treatment of horse D.

In the case of calf M, the result of this injection of serum was to produce a slight rise in temperature temporarily, but no trypanosomes appeared in the blood, though undoubtedly the calf must have been infected with trypanosomes since the same serum proved infective to horse 1, and moreover this calf fell in condition after injection and again recovered it.

*Horse F.*—This horse was, in March, 1908, inoculated with trypanosomiasis and infected, then he was treated by intravenous injections of perchloride of mercury with the following results: A fall in temperature, with a disappearance of trypanosomes from the blood, followed later by occasional relapses in rise of temperature, with or without the reappearance of organisms in the blood, and then finally an irregular temperature with a general falling-off in condition showing that the animal was suffering from a chronic form of infection or the results of it, although the trypanosomes could not be found in the blood.

Of all the horses treated by injections of perchloride of mercury this animal is the only one which survived with a chronic infection. In May, 1908, when, after treatment, this horse's temperature was normal and no trypanosomes could be found in his blood, 88 c.c. of blood were injected subcutaneously into calf K, with a view to trying to confer artificial immunity.

*Calf K* was, in May, 1908, injected subcutaneously with 88 c.c. of blood from horse F, after treatment with perchloride of mercury, with a view to conferring artificial immunity.

The blood of horse F was undoubtedly infective for it produced the disease in calf K, but the virulence of the trypanosome seems to have been lowered, as seen from the following: (1) A mild attack of the disease resulted in calf K; (2) a slight rise of temperature occurred but subsequently a normal course was run; (3) trypanosomes appeared in the blood temporarily with the first rise in temperature and were not seen again; (4) the calf fell off in condition at first, but improved again and became quite healthy and strong, having apparently recovered from a mild infection.

(11) *Controls sent from Maifoni.*—In December, 1909, the foregoing four animals mentioned in paragraph 10, viz., horses D and F, calves M and K, were sent from Maifoni to Ibi with a view to making further observations on them and conducting further experiments. As they had to march for five weeks to get to Ibi, and possibly have to pass through tsetse belts, although it was the dry season of the year, it was considered advisable to send certain animals as controls with them which would be subjected to the same sources of infection in the journey. With this view the following animals were sent as controls from Maifoni to Ibi: Horse 1 (a grey), calf 1 (a brown and white), calf 2 (a black), calf 3 (a dark brown and white). The blood of these controls was examined for trypanosomes by Dr. Moiser, the Medical Officer, at Maifoni, before they were sent to Ibi.

(12) *Other Animals used in Experimental Work at Ibi.*—Pagan bull No. 4, obtained from Lokoja, calf 5, calf 6. The two latter were bought at Ibi and the work on them will be recounted later.

(13) *Further Observations and Experiments conducted at Ibi on the Animals which came from Maifoni in January*, 1910.—These were eight in all,

four of which had been experimented on (see paragraph 10), and four had come as controls with them (see paragraph 11).

*Horse D* arrived at Ibi in fair condition, considering the long march from Maifoni, and picked up with rest. This horse was now under observation and experiment from January 21 to August 4. His morning and evening temperature was registered daily—the temperature practically ran normal from January 21 to May 24, 1910, during which period seventeen blood examinations were made for the presence of trypanosomes, but found negative. It was therefore concluded that this horse, which had been treated for the disease in Maifoni, had recovered from it for the following reasons:—

(i.) His temperature ran normal and no trypanosomes were found in his blood; he had evidently not been subjected to re-infection, for all the four controls, viz., horse 1 and calves 1, 2 and 3, which come from Maifoni, showed no signs of infection.

(ii.) On April 27, 28 and 29, a certain quantity of blood was daily inoculated from horse D into horse 1, so that the total blood injected into horse 1 was 65 c.c.; this was done with a view to ascertaining if the blood of horse D was at all infective, and also to try and see if the injection of this blood had any immunizing properties. It will be seen later that horse I did not become infected by the injection of this blood from horse D, for he showed no rise in temperature during the incubation period after the last day of injection. On May 15, 16 and 17, further injections of blood from horse D were made into horse 1, and altogether 84 c.c. of blood were injected. It would be as well to mention here again that the tsetse-fly made its appearance on May 15, so that both the horses D and 1 were now open to infection naturally. In the case of horse 1, the first injection of 65 c.c. of blood caused no rise of temperature for thirteen days and during this period four blood examinations gave a negative result, so that it is evident that the blood of horse D was not infective. On May 31, however, *i.e.*, fourteen days after the second inoculation, there was a sudden rise of temperature with an invasion of blood by trypanosomes. Subsequently horse D fell off in condition. On June 24, when trypanosomes were found in his blood, subcutaneous injections of soamin, 50 gr. daily, were begun and continued for seven days, with the following effects: (1) A reduction in temperature; (2) A disappearance of trypanosomes from the blood; (3) loss of œdema of the limbs.

After this the horse was put on to 9 gr. of arsenic a day by the mouth, but relapses of temperature occurred, together with the reappearance of trypanosomes in his blood; the horse fell off in condition and died on August 4.

The trypanosomes found in the blood of horse D, as well as that in horse 1, was the *Trypanosoma brucei*, of Nagana. Horse 1 finally grew weaker and succumbed to the disease on September 8, 1910.

*Conclusions based on the Cases of Horse D and Horse* 1.—(1) Horse D recovered from an attack of infection by *T. brucei* as a result of treatment by intravenous injection of methylene blue, followed by injections of perchloride of mercury, but the former had no therapeutical effect whatever. (2) One attack of the disease in horse D due to the *T. brucei*, and recovery as a result of treatment, did not render the animal immune to subsequent natural infection by *T. brucei*. (3) The inoculation of 149 c.c. of blood from horse D, which had recovered from an attack, into horse 1, failed to confer artificial immunity. (4) Treatment of a second infection of horse D naturally by *T. brucei* by means of subcutaneous injections of 50 gr. of soamin daily improved the animal, as seen from the following results: (*a*) A reduction of temperature; (*b*) a disappearance of trypanosomes from the blood; (*c*) a loss of œdema of the limbs; but cure did not result, and this was due to the fact that the animal was under treatment where the fly was constantly present and the animal subject to daily re-infection.

*Horse F.*—This horse was treated in 1908 for trypanosomiasis by intravenous injections of perchloride of mercury, without any curative effect, and on his arrival at Ibi, in January, 1910, he was still suffering from chronic infection, for he was quite a skeleton; his temperature registered 105° F. and his blood was found to contain trypanosomes. The animal, when kept at rest, continued to show a low fever, although the trypanosomes disappeared from the blood; he fell off in condition and died on March 19, 1910.

I do not consider that this animal got re-infected, nor did the controls, horse 1 and calves 1, 2, and 3 become re-infected. The fatigue to which this horse was subjected on the journey down undoubtedly lowered his vitality and the clinical symptoms of the disease became apparent.

*Calf M* was injected with 30 c.c. of blood serum from horse D at Maifoni, with a view to conferring immunity on the calf, but the blood proved infective in that it produced a mild attack of the disease which persisted in a chronic form, so that when the calf arrived at Ibi on January 21, after the long march, his condition was very poor; the temperature showed marked rises, and the blood was found to contain trypanosomes. The calf died of the disease on February 14. I consider that the present infection was a continuation of the original infection conveyed by inoculation of blood serum from horse D, and not a fresh infection acquired on the journey down, for, as already mentioned, neither did horse D nor calf K, nor did any of the controls, viz., horse 1, calves 1, 2, and 3, get infected.

*Calf K.*—This calf was injected with 88 c.c. of blood from horse F, after this horse had been subjected to treatment by perchloride of mercury with a view to conferring artificial immunity on the calf. The result was that the blood of the horse proved infective and produced a mild attack of the disease in calf K, from which the calf recovered.

When calf K arrived at Ibi on January 21, after the long march, it was in good condition, the tem-

perature ran normal for three months up to May 1, and repeated examinations of the blood for trypanosomes gave negative results. On May 12 and 13 blood from calf K was injected into calf 1—the total blood injected was 100 c.c.—and at the same time blood was drawn from calf K and 120 c.c. serum injected into calf 2. Both these injections of blood and serum from calf K were made with a view to ascertaining if the blood contained any immunizing properties. It might again be mentioned that the tsetse-fly had now made its appearance on May 15, so that the two calves (1 and 2) were both open to natural infection after injection. By May 20 both these calves (1 and 2) had a rise of temperature and showed trypanosomes in the blood which was undoubtedly the result of natural infection, for calf K, which had been perfectly healthy for all the months, now also showed a rise of temperature on May 20 with trypanosomes in its blood, which must have been due to natural infection, and all the three calves, K, 1 and 2, were naturally infected at the same time when the fly first appeared.

Calf K finally died from the disease on September 27, 1910. Calves 1 and 2 both fell off in condition and finally succumbed to this infection, the former on July 22 and the latter on August 23, 1910.

*Conclusions based on these Cases of Calf K, Calf* 1, *and Calf* 2.—(1) That a mild attack of trypanosomiasis was produced in calf K by inoculation of the attenuated virus from horse F, from which the calf recovered without treatment. (2) That a mild attack of the disease in calf K due to an attenuated strain of *T. brucei* from a horse did not produce any immunity, for when calf K was subsequently subjected to natural infection it developed the disease and died from it. (3) That the injection into calves of 100 c.c. of blood and 120 c.c. of blood serum from calf K, which had recovered from a mild attack of trypanosomiasis due to inoculation by an attenuated strain of *T. brucei*, did not protect these animals against subsequent natural infection due to a fresh strain of *T. brucei*.

*The Controls from Maifoni.—Horse* 1.—This horse came as a control to horse D, and arrived in Ibi without being infected on the journey. He was further experimented on with a view to immunizing him by injection of blood from horse D. Details of the experiments and conclusions are given in paragraph 13. *Calf* 1 *and Calf* 2.—These are two calves which came from Maifoni and served as controls to calf K. They arrived at Ibi without being infected on the journey and were subsequently injected, calf 1 with blood and calf 2 with serum from calf K, an animal that had recovered from a mild attack of the disease, with a view to immunizing them; but the injections failed to have this effect as the two calves subsequently, when exposed to natural infection, contracted the disease and died from it. (For details of the work, see paragraph 13 and conclusions at end of report.) *Calf* 3.—This animal also came from Maifoni as a control. He arrived at Ibi in a poor condition and was found to be suffering from dysentery; the blood on examination showed no trypanosomes. In the course of fifteen days after arrival the animal recovered and later was used for experiments in connection with the pagan bull No. 4, which was brought from Lokoja.

(14) *Experiments conducted at Ibi.*—(I.) *Experiments in Treatment* by (*a*) Injections of perchloride of mercury; (*b*) injections of methylene blue, followed by perchloride of mercury; (*c*) the Fagan treatment by the mouth; (*d*) arsenic by the mouth; (*e*) soamin injections.

(II.) *Experiments in Immunity:* Attempts to (*a*) Immunize a horse with blood from a horse that had recovered from trypanosomiasis after treatment; (*b*) immunize calves by injection of blood and serum from a calf that had recovered from a mild attack of the disease produced by the inoculation of an attenuated strain of trypanosome; (*c*) immunizing of calves by the injection of blood and serum from a bull which apparently possessed natural immunity as it survived for years in a fly area and remained in good health and condition.

(I.) *Experiments in Treatment.*—(*a*) Horse 3 was naturally infected in a fly belt between December 6 and 10, 1909, and showed signs of being ill aften ten days. On December 26 the blood showed trypanosomes. Treatment by daily intravenous injections of 10 c.c. of perchloride of mercury solution (1 in 1,000) was begun and continued for ten days, but the treatment proved of no value in this case as it did not remove the trypanosomes from the blood and the horse died. (*b*) *Horse* 4 naturally infected in a fly belt between December 6 and 10, 1909. On December 28 the blood was found to contain trypanosomes *T. brucei*. Treatment by daily injection of 10 c.c. solution of perchloride of mercury was begun and continued for ten days, a temporary improvement occurred followed by relapse. Later, on April 19, the Fagan treatment of giving by the mouth arsenious acid 3 gr. three times a day, and perchloride of mercury solution (1 in 1,000) 1 oz. three times a day in the drinking water was begun.

It was found most convenient to mix the arsenic powder with some dussa and then make a mash with a little ground nut oil which the animal readily licks up. The effect of this treatment was to improve the animal's condition with a disappearance of the trypanosomes from the blood; but relapse occurred; the temperature, however, never regained the normal and the horse died on June 18.

(*c*) *Horse* 5, on February 27, 1910, was found to be infected with *T. brucei*. Ten cubic centimetres of methylene blue solution was injected intravenously for three days without effect, and then 10 c.c. of perchloride of mercury solution (1 in 1,000) was injected daily and intravenously, resulting in a normal temperature, but trypanosomes could still be found in the blood. No further treatment was, however, given, and the horse fell off considerably in condition;

later the condition improved again, and on April 16, one month before the tsetse-fly made its appearance, the Fagan treatment was begun. Arsenic 3 gr. was given by the mouth three times a day, but as the animal persistently refused to drink the water containing the perchloride of mercury solution this was discontinued and only the arsenic given. Under this treatment by arsenic the horse improved vastly in condition and the trypanosomes disappeared from the blood, but the temperature occasionally went up to 101° F.

This treatment by arsenic was continued to June 4, and June 5 the horse being in a very fit condition was used for a march of ten days, returning to Ibi by June 16. During this trip the arsenic was continued, but the animal was subjected to severe re-infection in its passage through intensely infected fly-belts, as a result of which, together with fatigue, he fell off greatly in condition. On his return to Ibi with rest and good feeding he again improved in condition, the arsenical treatment being steadily continued up to July 18; at this time the amount of arsenic was reduced from 9 gr. to 6 gr. a day. By August 1 it was quite evident that this amount of arsenic was insufficient to act as a prophylactic when the animal was in a tsetse-fly area and subject to constant re-infection as was the case here, for the temperature rose again, anæmia with œdema of the legs set in, and occasionally trypanosomes could be found in the blood. On August 16 the dosing of arsenic was again increased to 9 gr. a day with beneficial results; the animal rapidly improved in condition, the temperature became more normal, œdema disappeared and trypanosomes disappeared from the blood. On September 7, owing to a severe skin eruption having broken out, all arsenic was discontinued; this eruption now got better, and on September 17 arsenic in 6 gr. a day was again begun and continued up to October 10, when I left Ibi to proceed on leave to England. This horse, I should mention, was in constant daily use while under treatment, and subsequent news received regarding this horse was that he was alive and doing well in December, 1910.

(*d*) *Horse* 6.—On February 28, 1910, this horse was found to be naturally infected with *T. brucei*. On March 1 treatment was begun; for three days daily injections of methylene blue were made, and then for five days daily injections of perchloride of mercury solution (1 in 1,000) 10 c.c. The methylene blue had no effect, but after the mercurial injections the temperature was reduced, the horse improved, and trypanosomes disappeared from the blood; this improvement was, however, temporary, for a relapse occurred and the animal fell off in condition, with œdema of the legs and trypanosomes again in the blood. On April 16 the Fagan treatment was begun, 3 gr. of arsenic were given three times a day and 1 oz. of perchloride of mercury solution (1 in 1,000); the animal improved wonderfully in condition, the œdema disappeared, the temperature ran normal and trypanosomes disappeared from the blood, and his general spirits returned to almost normal. On July 25 all treatment was suspended, with the result that the temperature rose again, the horse became depressed and went off feed. On August 24 the Fagan treatment was again begun, but the beneficial results of the treatment after this relapse were not so marked as the effects of treatment in the first instance. On October 10, when the experimental work came to an end, the horse had again improved much, but must have relapsed subsequently, as it died at the end of the year.

(*e*) *Horse* 7.—This horse on May 20 was in very good condition and apparently in perfect health and spirits, but he had a history of having been very ill in February the same year with symptoms of trypanosomiasis, but had again improved and was now looking very fit. The temperature was taken and found to be 101° F., and the blood on examination showed the presence of trypanosomes, so that the infection in him was of a chronic nature. On June 1 the Fagan treatment was begun, and continued up to July 25, when it was discontinued. During this course of treatment the temperature practically showed no change, as it continued to range between 100 and 101° F., and the trypanosomes could at times be found in the blood. By August 19 the temperature ran up, trypanosomes appeared in the blood and the animal got reduced in condition. On August 20 the Fagan treatment was resumed, only the arsenic was given in 6 gr. a day, and with perchloride of mercury twice a day. The horse, however, grew worse—he fell off in condition, his temperature rose, trypanosomes could usually be found in his blood any day, he grew weaker and died on October 3, 1910.

(*f*) *Horse* 8 was one which was naturally infected by the *T. brucei*, but was apparently ill some time before it was brought for treatment. On August 25 the blood was found to contain trypanosomes. The Fagan treatment was begun at once, but the condition of the animal steadily grew worse, and he died on October 3, 1910.

NOTE.—It would be as well to mention here again that at the time these horses, 5, 6, 7 and 8 were under treatment the tsetse-fly was prevalent and that they were constantly being re-infected, so that the therapeutical value of the treatment could hardly be fairly estimated in that it had to act as a prophylactic also.

(*g*) *For the Treatment by Soamin Injections*, see the case of horse D, paragraph 13.

*Conclusions as to Results of Treatment.*

(i.) That methylene blue injected intravenously has no curative value.

(ii.) That perchloride of mercury has a beneficial effect, but of a temporary nature, as relapses occur. Only one case (horse D) is known to have recovered after treatment by mercury following on injections of methylene blue.

(iii.) That the Fagan treatment by arsenic and

perchloride of mercury is of value in the treatment of cases if treated in the early stages of the disease, and, moreover, it acts as a prophylactic in a tsetse-fly area so long as the arsenic is given in doses of 3 gr. three times a day, and the perchloride of mercury solution (1 in 1,000) is also given three times a day; if these doses be reduced relapses occur where re-infection is daily taking place. Its full curative value can only be ascertained by treating recently infected animals in a place free from tsetse-flies so that re-infection cannot occur.

(iv.) That arsenic alone given in doses of 3 gr. three times a day has a curative value in a case if treated in the early stages soon after infection, and it also acts as a good prophylactic in an area where constant infection is taking place. Its full curative value can only be judged by treating cases in the early stages soon after infection at a place where tsetse-flies do not exist and re-infection cannot occur.

(v.) That soamin when injected subcutaneously into a horse in an advanced stage of the disease improved his condition is seen from (*a*) the fall in temperature, (*b*) the disappearance of trypanosomes from his blood, and (*c*) the loss of œdema of the limbs.

(II.) *Experiments in Immunity.* — Experiments to confer immunity were conducted on the following lines: (*a*) Immunization of a horse by the injection of blood from a horse that had recovered from an attack of trypanosomiasis as the result of treatment (see paragraph 13 for details of the experiments and for conclusions on the results). Horse 1 was used for this purpose; he was injected subcutaneously with 149 c.c. of blood from horse D. Later he was subjected to natural infection by the bites of *G. tachinoides*, and he developed the disease, showing that no immunity was established.

(*b*) Immunization of calves by the injection of blood and serum from a calf that had recovered from a mild attack of trypanosomiasis produced by the inoculation of an attenuated strain of trypanosome in a horse, the attenuation being the result of treatment and the constant passage of the strain through several animals by direct inoculation (for the details of these experiments, see paragraph 13, the conclusions based on their results appear later). For these experiments the blood of calf K was used; 100 c.c. blood was injected into calf 1, and 120 c.c. of serum was injected into calf 2, with the object of trying to confer immunity. Subsequently both these two calves (1 and 2) were subjected to natural infection and they contracted the disease, so that the blood and serum of calf K did not contain any immunizing properties.

(*c*) Immunization of calves by the injection of blood and serum from bull No. 4, that apparently possessed natural immunity, as it survived in good condition and remained healthy for years in a place where the fly existed, whereas other animals were constantly becoming infected with the disease in the wet season and dying from it.

For this purpose the following animals were used: (1) pagan bull No. 4. (2) calf 3 (one of the controls from Maifoni). (3) calf 5 and calf 6 (both bought at Ibi for experimental work).

*The Pagan Bull No.* 4.—A black bull that was got up from Lokoja to Ibi for experimental purposes. This animal was one of two that were originally obtained from pagan country near Lokoja, and hence I refer to him as "pagan bull." The physical characters of this breed of animal were: The body frame was thick-set and broad and comparatively long for its height, the legs thick and short, the neck thick and short, the head short, and the horns short. This bull was a good specimen of this breed of cattle met with in many parts of the country inhabited by pagan tribes. This bull was over two years in Lokoja, a place where infection and tsetse flies exist during the wet season. As he survived in a fly area and kept in good condition, it was considered that he might be immune to infection, and hence he was got up to Ibi at my request by the Principal Medical Officer. At Lokoja the bull lived free and was never subjected to confinement. He was brought up to Ibi in a canoe on December 20, 1909, and was in the very best of condition, his temperature ran normal, and his blood showed no trypanosomes. He was, however, tied up and kept in confinement now. The bull remained free from fever until February 1 when the temperature showed a rise, but still the blood on examination showed no trypanosomes. On February 2 his temperature was still high and reached 105.2° F., but still no trypanosomes were found in the blood. As the blood serum of this animal was to be used for the purpose of trying to immunize calves it was considered advisable to try its blood now to see if it was effective, although microscopical examinations gave negative results, for if it contained trypanosomes it was most likely to do so now when the temperature was high. On each of the following four days, viz., February 2, 3, 4, and 5, blood from bull 4 was injected into calf 5; the total blood injected was 50 c.c.

*Calf* 5 was a healthy calf that was injected with 50 c.c. of blood from bull 4 when the temperature of bull 4 was high. Five days after the last injection of blood calf 5 showed a rise in temperature to 106.2° F., and blood examination showed trypanosomes. The temperature now ran high continuously, he fell off in condition, and died on April 4 from the disease. On *post mortem* a large amount of pericardial effusion was found.

*Subsequent History of Pagan Bull No.* 4.—On February 6, when the temperature was again normal and no trypanosomes were to be found in the blood, blood was drawn and 26 c.c. serum obtained from it was injected into calf 3.

*Calf* 3.—With a view to trying to immunize him provided the serum did not prove infective. This calf had come as a control from Maifoni and had arrived in a poor condition owing to its suffering from dysentery, but now had recovered its health,

and as it had no trypanosome infection of its blood it was injected with this serum. The temperature chart of this calf after injection was most carefully watched and the blood examined several times, but no rise in temperature occurred and the examination of the blood always gave a negative result. The calf improved in condition and remained healthy until the month of June, when the temperature rose to 104.8° F., and now the blood showed the presence of trypanosomes. The calf had now been naturally infected by the fly, which was prevalent since May 15. This showed that the injection of serum from the blood of bull 4, although it was not in itself infective, did not give rise to any immunity when injected into calf 3, for calf 3 succumbed to natural infection.

*Final History of Pagan Bull* 4.—After it showed a rise of temperature in February and its blood proved to be infective to calf 5, which showed that the bull carried the infection in his blood, the bull fell off in condition during the dry season, when green grass was not available right up to the end of April; in May, with the onset of the wet season and with plenty of green food, the animal began to improve in condition notwithstanding constant re-infection now due to the presence of the fly. Right through the wet season the bull kept in good condition; on May 24 he showed a rise of temperature to 107° F. and trypanosomes in the blood, after this his temperature again ran fairly normal with occasional rises, but his condition remained very good until October 10, 1910, when the experimental work came to an end.

*Calf* 6 was a healthy calf brought on May 13 to act as a control to the work being done on calf 3, which had been infected with serum and had shown no signs of infection as a result of it. Both calf 3 and calf 6 were, therefore, now kept together during the wet season, and both were subject to the same degree of natural infection by flies. When the fly appeared both calves were bitten and both became infected. Calf 6 showed infection of the blood by trypanosomes on May 30, and calf 3, which had been injected with blood serum from bull 4, showed signs of being naturally infected on June 20, and both calves died from the disease. Had this control calf 6 died from the disease and had calf 3 survived, it would have been strong evidence in favour of the serum of pagan bull 4 having acted as a prophylactic, which, however, was not the case.

*Results obtained in Immunity Experiments.*—(*a*) The subcutaneous injections of 149 c.c. of blood from a horse, that had recovered from an attack of trypanosomiasis as the result of treatment, into a healthy horse did not serve as a prophylactic, for when the latter was subjected to natural infection he became infected and died, so that no immunity was developed.

(*b*) The subcutaneous injection of 100 c.c. of blood and of 120 c.c. of serum from a calf that had recovered from a mild attack of the disease, produced by the inoculation of an attenuated strain of trypanosome in a horse—the attenuation being the result of treatment and the constant passage of the strain through several animals by direct inoculation one from the other—into other calves failed to confer any immunity, as the two calves, inoculated one with the blood and the other with the serum, subsequently contracted the disease when exposed to natural infection and died from it.

(*c*) (i.) That a certain breed of cattle found in pagan districts possess a high degree of natural immunity in that they may harbour the trypanosome in the blood and yet keep in good condition and show no signs of the disease, nor do they die from the infection so long as their environments are favourable. These environments are a free life, with ample food, especially plenty of green grass. Confinement, poor feeding, and hard exercise, tend to make the disease manifest itself clinically.

(ii.) That such domesticated cattle may act as a reservoir of infection since the blood may prove infective at such times when clinical symptoms manifest themselves, although the trypanosome may not be found on making a microscopical examination.

(iii.) That the subcutaneous injection of 26 c.c. of serum obtained from the blood of one of these cattle when manifesting no clinical symptoms of the disease did not prove infective when inoculated into a calf, nor did it act as a prophylactic when the calf was exposed to natural infection subsequently.

(15) *General Summary of Results and Observation* obtained from all the experimental work conducted both at Maifoni and at Ibi covering a period of three years from October, 1907 to October, 1910:—

(I.) *Primary Remarks:* (*a*) At Maifoni no tsetse-flies existed and hence no natural infection, which was favourable to obtaining accurate results and conclusions in treatment of the disease; (*b*) at Ibi no tsetse-flies existed from January to May 15, 1910, when part of the experimental work was being done, whereas from May 15 to October natural infection by flies was constant, and the full therapeutical value of the Fagan treatment, or the treatment by arsenic alone, could not be estimated owing to the constant reinfection of animals under treatment; (*c*) all strains of trypanosomes used or met with in the work were of the *T. Brucei* type.

(II.) *Results of Treatment*:—A. *In Horses.* (*a*) That methylene blue solution injected intravenously has no therapeutic value. (*b*) That perchloride of mercury injected intravenously has some beneficial effect, but of a temporary nature, as relapses occur in most cases, only one case having recovered when the perchloride injections followed on those of methylene blue, and hence the drug is by no means a specific. The injection of a mixture of methylene blue and the perchloride gives the same results as the perchloride alone. (*c*) That the Fagan treatment by arsenic 3 gr. three times a day and perchloride of mercury solution (1 in 1,000) 1 oz.

three times a day by the mouth is of very considerable value in the treatment of cases if they are treated in the very early stages of the disease and, moreover, that it acts as a prophylactic in a fly area so long as the drugs are given in the above-mentioned doses, for if the doses are reduced relapses occur when daily infection is naturally taking place. Full curative value can only be ascertained by treating recently infected horses in a place free from tsetse-flies. (*d*) That arsenic alone given in doses of 3 gr. three times a day by the mouth has a curative value in a case treated in the early stages soon after infection, and that it also acts as a good prophylactic in these doses where natural infection exists. To estimate its full curative value cases must be treated in the early stages in a fly-free area. (*e*) That soamin, when injected subcutaneously into a horse in an advanced stage of the disease improves his condition, as seen from (1) the fall in temperature, (2) the loss of œdema of the limbs, and (3) disappearance of trypanosomes from the blood.

B. *Oxen and Calves.*—In the case of these, treatment by (1) methylene blue injections, (2) methylene blue and perchloride of mercury, (3) perchloride of mercury injections have all proved of no value.

(III.) *Results of Immunity Experiments*: A. *In Horses.*—(1) The subcutaneous injection of 149 c.c. of blood from a horse that had recovered from an attack of trypanosomiasis as the result of treatment into a healthy horse did not serve as a prophylactic, as the inoculated horse was not rendered immune to natural infection. (2) Recovery of a horse from one attack of trypanosomiasis did not render the animal immune to a second fatal attack caused by natural infection. (3) A strain of trypanosome by constant direct passage through a series of animals as well as by treatment of these animals undergoes an attenuation so as to cause a mild attack in calves from which recovery may occur.

B. *In Cattle.*—(*a*) The inoculation of an attenuated strain of trypanosome, as mentioned under III. A. (3) (preceding paragraph), from a horse into a calf produced a mild attack of the disease in the calf, from which it recovered. (*b*) The inoculation of two calves, one with 100 c.c. of blood, the other with 120 c.c. of serum taken from a calf that had recovered from a mild attack of the disease (as mentioned in (*a*) did not render them immune to natural infection, which moreover proved fatal to them. (*c*) A mild attack of the disease in a calf by an attenuated strain of trypanosome and from which the calf recovered did not render the animal immune to subsequent natural infection to which it eventually succumbed. (*d*) A certain breed of cattle met with in pagan countries possess a high degree of natural personal immunity, in that they may harbour the trypanosome in their blood and yet keep in a healthy condition, showing no clinical signs of the disease, nor do they die from the presence of the infection so long as their environments are favourable. (*c*) The blood serum of such cattle as mentioned in (*d*) does not necessarily prove infective by inoculation into another animal (such as a calf), and on the other hand it fails to act as a prophylactic against subsequent natural infection.

(IV.) *Other Observations.*—(1) Certain breeds of domesticated cattle may harbour trypanosome infection in the blood without manifesting clinical symptoms and so act as reservoirs of infection. (2) In all cases where the Fagan treatment or arsenical treatment is to be adopted it should be begun in the very earliest stages if curative or prophylactic effect is to be obtained. (3) As a prophylactic in areas where the fly prevails periodically with the onset of the wet season it is necessary that the Fagan treatment, or arsenic treatment, be begun ten to fifteen days before natural infection becomes possible. (4) The simplest method of giving the powdered arsenic is to mix it with a handful of dussa and then make it into a mash with ground nut oil. Most horses will lick this up. (5) A horse with chronic trypanosome infection, although the organism may not be found in his blood, always shows a low afternoon rise of temperature to 100.6 F. or 101° F., or even more while he is kept at rest; his condition is not usually of the very best and he is unfit for prolonged fatigue; if subjected to this, he loses condition and clinical symptoms appear, with trypanosomes in his blood.

(16) In conclusion, I wish to thank Captain Knight and Captain Ruxton for the assistance they gave me in helping me to carry out the experimental work at Ibi, and my thanks are also due to Dr. Alexander and Dr. Moiser for the care of my experimental animals at Maifoni when I was on leave.

## SALVARSAN.

### A Note of Warning.

By John Campbell Graham, M.D.
*Deli, Sumatra.*

The results of my first series of 106 salvarsan injections, including hospital and private practice, were encouraging but variable. The series includes syphilis in all its forms, 1, 2, 3; one case of tubercular leprosy, and two cases of frambœsia tropica.

The best results were obtained in the secondary and tertiary stages of syphilis and in frambœsia. In the former the symptoms rapidly subsided after the first injection, and the second was only occasionally required. The best of all was a case of episcleritis in a Chinaman which had resisted all other treatment for years. He was completely cured in a week. Again a case of syphilitic iritis reacted very promptly, the patient leaving hospital after four days. In primary syphilis the initial sclerosis healed rapidly as a rule, but not more so than under ordinary treatment. It remains to be seen if secondary symptoms develop later on.

The case of leprosy was much benefited as regards

his tubercles, which visibly decreased in size, but two days after the injection of 0·6 salvarsan he became completely paralysed in his lower extremities, and only recovered the use of his limbs after three months.

The result in frambœsia tropica was striking, and apparently a complete success. The accompanying photos show one man, a Javanese, called Singovidjojo, at the time of treatment and a month later. He was injected with 0·4 salvarsan intravenously on April 5, and left hospital on 17th. The crusts began to drop off the day after the injection, and the whole crop had disappeared on 17th. Up to now he has had no return.

Yaws before treatment with Salvarsan.

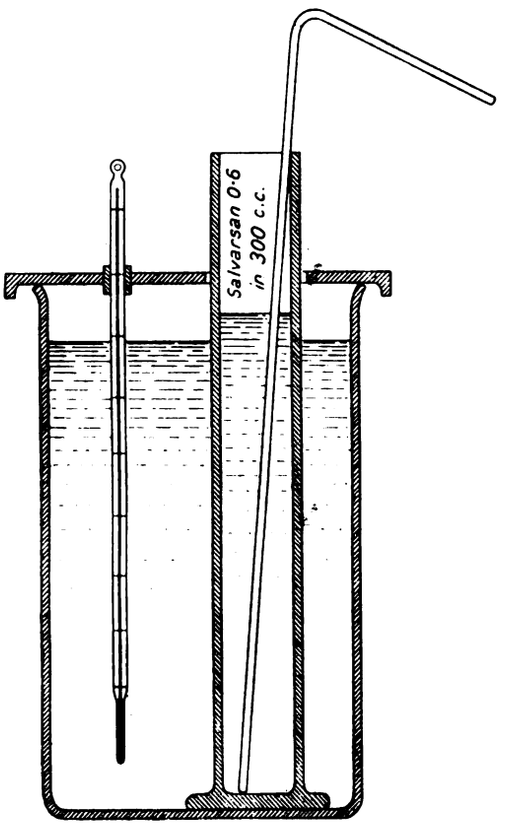
After treatment.

All my early cases I injected subcutaneously first at the back of the left elbow, and later between the shoulder blades, but owing to repeated necroses at the place of injection I gradually gave up this method, and now only inject intravenously. The apparatus I have hitherto used was kindly made for me by my assistant, Mr. S. Elders, at the Brahrang Central Hospital, to whom also my thanks are due for his able assistance in carrying out these injections.

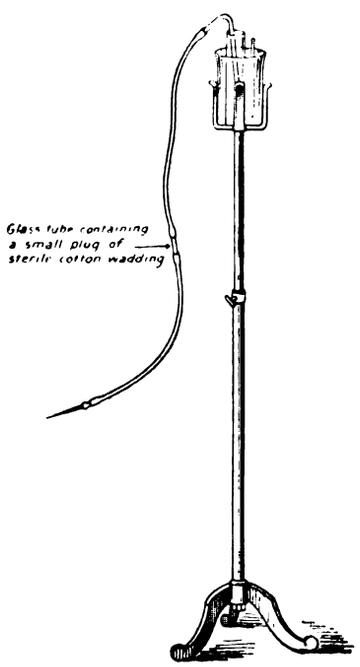
In most cases there has been a sudden rise of temperature three to four hours after the intravenous injection, between 38 and 40° C., lasting from six to twelve hours, and followed by a sense of increased well-being and a general improvement in all the symptoms.

Unfortunately there has been one exception to this course of complete recovery after the initial rise of temperature after the intravenous injection of 0·4 salvarsan, and this happens to be the last of my series. The man was suffering from an obstinate pharyngeal ulcer. He had been under treatment with ¾ c.c. of a 1 per cent. solution intragluteal injection of bichloride of mercury daily for ten days, he then had a course of potassium iodide for two weeks. To accelerate his recovery I decided to inject 0·4 salvarsan intravenously. After the usual initial rise the man's temperature returned to normal on the following morning, but he complained of general malaise and pain in his loins and epigastrium. All treatment failed to alleviate this and he required morphia injections to get even a little sleep at night.

By way of nourishment he could only stand a little milk: symptoms of paraplegia supervened and gradually became worse. He became unconscious on the morning of the fifth day after the injections with




fixed pupils and tonic spasms. *Post mortem* there were extensive extravasations varying in size from a millet seed to a split pea and even larger all over the




serous lining of the chest and pericardium and on the heart itself. The blood itself was also more diffluent than usual. Heart, kidneys, liver and spleen were all in a more or less pulpy condition: the spleen was enlarged and contained a small abscess in its lower segment. Taking the condition of the patient at the time of the injection when he was clinically comparatively well, with the exception of his pharyngeal ulcer, I think it quite impossible for the death on the fifth day after injection to be ascribed to any other cause than the salvarsan. Under these circumstances in spite of the occasional brilliant results achieved with salvarsan, patients ought to be warned that a certain number of cases end fatally, death being directly due to its use, so that they may know what risks they incur.

Salvarsan is a sharp, but double-edged sword, to be used with the utmost caution in all cases, and even with the uttermost precautions it is sometimes fatal.

*Davainea Madagascariensis*: Garrison, in the *Philippine Journal of Science* (vol. vi., June, 1911, No. 3), reports the finding of *Davainea Madagascariensis* in the Phillippine Islands. As he states, the discovery is of particular interest because the last finding of this parasite was fourteen years ago, and the case under discussion is only the sixth reported. Dr. Andrews collected the samples from the small intestine of an adult male Filipino at the Morgue, in Manila, in March, 1909. Dr. Garrison states that the first three findings of *D. Madagascariensis* in the islands off Madagascar, in 1867, 1873 and 1891, might well have been taken to indicate a possibly narrow range of distribution in that locality, although one of the cases had come from the Antilles five months previously. Krabbe's case at Bangkok in 1891 widened the range, and Daniels' case in British Guiana in 1895 clearly indicated that the parasite probably had a world-wide distribution. The encountering of the parasite now in the Philippine Islands bears out this latter contention. Little is known of how the parasite is spread, or whether it is a parasite of man *per se*, or only accidentally from some of the lower animals. Garrison shows that there is an apparent relation between the incidence of the infection and maritime surroundings. The first seven cases were insular and all ten were found at port towns. Krabbe's case was the son of a sea-captain, the boy living on his father's vessel. This may mean that the intermediate host is an animal of wide distribution in the Tropics, infesting ships and docks for example, such as the cockroach—a suggestion put forward by Blanchard. More researches are required on the subject and medical men doing autopsies in the Tropics should always carefully collect any parasites found in the intestines and deliver them to some well-recognized helminthologist, who can later decide as to their identity. Much new information will be acquired by carrying out this plan.

## Business Notices.

1.—The address of the JOURNAL OF TROPICAL MEDICINE AND HYGIENE is Messrs. BALE, SONS AND DANIELSSON, Ltd., 83-91, Great Titchfield Street, London, W.

2.—All **literary communications** should be addressed **to the Editors.**

3.—All **business communications** and **payments**, either of subscriptions or advertisements, should be sent **to the Publishers** of the JOURNAL OF TROPICAL MEDICINE AND HYGIENE. Cheques to be crossed The Union Bank of London, Ltd.

4.—The Subscription, which is **Eighteen Shillings** per annum, may commence at any time, and is payable in advance.

5.—Change of address should be promptly notified.

6.—Non-receipt of copies of the Journal should be notified to the Publishers.

7.—The Journal will be issued on the first and fifteenth day of every month.

THE JOURNAL OF

# Tropical Medicine and Hygiene

OCTOBER 16, 1911.


## THE STARTING POINT OF PANDEMICS.

THE words "endemic" and "epidemic" are familiar terms in our epidemiological nomenclature, but the epithet, "pandemic," is less in evidence. We might cover much space in an academic discussion as to the precise distinction between the diseases which assume epidemic proportions and those which behave in pandemic fashion, but, it is to be feared, with little benefit. It is interesting to note, however, that pandemics reach countries in which the particular disease they carry is not endemic, whereas epidemics are usually but acute outbreaks of endemic ailments in a given locality.

The three diseases which assume pandemic proportions are plague, cholera and influenza. Of these, influenza is the most marked in its universality, and the most rapid in its spread. The actual source of influenza, from an epidemiological point of view, is unknown. In the intervals between the severe ravages it occasions sporadic cases and even epidemics may prevail, and it would seem from the occurrence of "influenza colds" that the disease might be regarded as endemic. In the pandemic form, however, its effects are not only more universal, but the virulence of its toxic power is more marked. Where influenza has its home, if a definite home there be, is a difficult point to settle. The 1889 pandemic is admitted to have commenced in China; the Russians called it Chinese influenza, Western Europe dubbed it Russian influenza, America considered that it became infected from Europe, and the Japanese believed they were infected from America. The infection travelled from East to West, and encircled the world. It would appear that China was its source, and at one time its beginnings were ascribed to the pollution of the air arising from the decomposing bodies of thousands of Chinese drowned by the overflow of the Yellow River, and left unburied. The author of this statement remarked that just as the dust from Krakatoa fell upon the earth from east to west for a year or two after the eruption, so he believed that the polluted air brought about influenza as the earth passed in its revolution beneath the area of polluted air in China. A fanciful belief, no doubt; but, if it did nothing else, it served to focus the belief that in China influenza had its beginnings.

Plague seems cradled in several centres, but the North of India and Western China are held to be the points from which the disease starts now in epidemic form, but occasionally as a pandemic. Since 1894, when plague became epidemic in Southern China, the plague has spread in every direction, until but few countries have not suffered from the disease to some extent. India or China would appear to be the source of plague. In these countries it first becomes epidemic, and a pandemic may or may not result. Cholera is more readily focussed. Certain towns, villages, or districts in Northern India are considered to be the birthplace of the pandemics cholera at times occasions.

China and India would appear, therefore, to be the homes of the three great causes of pandemics, and one naturally asks—Why? What have these countries in common as distinct from the rest of the world? Off hand, one ascribes it to the unhygienic state in which the people in these countries live. This may be the case, but unhygienic surroundings are not confined to India or China by any means, nor are the people so untutored in hygiene as are many of those in less or even in more highly civilized communities. Can it be because of the number of inhabitants in India and China? Does density of population breed disease and foster its germs? If this is the case, there can be no doubt that the requisite elements are present, for in China is collected one-fourth of the inhabitants of the globe—that is, one in every four persons of the people on the earth is Chinese. When to this is added the 300,000,000 dwellers in India, it comes about that well-nigh half the population of the world are centred in the comparatively restricted areas of these two countries. This aggregation of human beings in India and China is no new development, as in the case of Western Europe and America, where overcrowding is but a thing of yesterday, whereas in India and China the population has been excessive for thousands of years. The soil also on which the people dwell has been closely cultivated to support the people with food from time immemorial. The actual effects of overcrowding over a large area have never been worked out, neither as regards the effect upon the physique of the people nor upon the diseases that the overcrowding may generate. It is a fact, however, that it is from the countries with huge populations that pandemics arise; but whether it is the overcrowding that tells, or the long-standing effect of closely cultivating the soil, or some other cause, that engenders the diseases which assume a pandemic character, it is impossible to say.

## Annotations.

*Yellow Fever.*—In the *Yellow Fever Bureau Bulletin*, No. 5, September, 1911, Dr. Seidelin states that no large outbreaks of yellow fever have occurred during the last few months. He does not believe, however, that the general outlook has brightened, because although there has been a decrease in the total number of cases, yet in several localities where no occurrence has been observed for months or years, now one or more cases have been reported. The infection, he states, seems in no instance to have been traced to its origin, since the source of infection is not stated. He believes, therefore, that the disease must have originated on the spot, and, therefore, that one must fall back upon the hypothesis that there has been a continuous occurrence of overlooked cases, probably in natives, to explain the facts. Further, he believes that it is questionable whether much importance can be attached to a decrease of the number of cases, as even the number of infected localities does not give an exact conception of the distribution and extent of yellow fever. At any rate, there is no doubt that the prevalence of the disease continues to be much under-estimated.

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*Paraffin Sections.* — H. R. McNair, Laboratory Assistant to the New York Post-Graduate Medical School and Hospital, describes in the *Post-Graduate*[1] a quick method for dealing with paraffin sections. He states that tissues manipulated by his method do not shrink, and that Sections 2 to 5 microns are easily obtained. The steps of his method are as follows :—

(1) Specimens must be immersed in acetic-formalin as soon after excision as possible, and kept in an incubator for one hour. The best results are obtained by keeping the tissues in the incubator during all the steps.

(2) Alcohol, 95 per cent., one hour.

(3) Absolute alcohol, one hour.

(4) Pure paraffin, one hour.

(5) Pour tissue and paraffin in paper box and embed. Transfer immediately to a large basin of iced water.

After the blocks have sufficiently hardened, trim to size, and cut.

As soon as a ribbon is cut, it is placed in a basin of tepid water, and allowed to spread out. Smear lightly some egg-albumen on a clean side, and draw the ribbon up on to this; allow to stand for a few minutes at room temperature. Place the slides for at least five minutes in a staining jar, filled with xylol. The sections are then ready for staining.

MODE OF STAINING.

Harris' hæmatoxylin, one to two minutes. Wash in water. Acid alcohol, until colour is pink. Ammonia water (0·5 per cent.) until colour is deep blue. Eosin solution for from one to two minutes. Alcohol (95 cent.) two baths, one to two minutes each. Creosote, five minutes. Xylol, one minute. Cover with Canada balsam and mount.

*Acetic-formalin.*

| | |
|---|---|
| Formalin, 40 per cent. | 250 c.c. |
| Distilled water | 700 ,, |
| Glacial acetic acid | 50 ,, |

*Harris' hæmatoxylin.*

| | | |
|---|---|---|
| (1) | Hæmatoxylin crystals | 1 grm. |
| | Absolute alcohol | 10 c.c. |
| (2) | Ammonia alum | 20 grm. |
| | Distilled water | 200 c.c. |

Place in separate bottles for twenty-four hours; mix one and two, and add 0·5 grm. of red or yellow mercuric oxide. Boil. Cool quickly, and after twenty-four hours filter. Add a small amount of glycerine; this prevents deposits, and the stain will keep for a long time.

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*The Prevention of Malaria.—The Indian Public Health and Municipal Journal* for September, 1911 (vol. viii., No. 2), gives in detail the particulars of a debate held before the Bombay Corporation on August 15, 1911, relative to Dr. Bentley's report on malaria in Bombay. Dr. Bentley, as is well known, is an expert on malaria and was appointed a "Malaria Investigation Officer" by the Government of India. Readers may have seen his report which was clear and to the point and demonstrated conclusively the reason of the epidemic of malaria in Bombay. Such being the case the report of the debate in the Corporation must come as a surprise and that a grievous one to all genuinely interested in the prevention of malaria. Old-time ideas die hard but one really would have thought that the excavation and digging the soil theory had long passed into the realms of the past. That it has not will be seen by a perusal of the remarks of the speakers at the debate in question, a full account of which we reprint from *The Indian Public Health and Municipal Journal* quoted above.

"At a discussion continued at the Bombay Corporation on August 15, on the recent report of Dr. Bentley, Malaria Investigation Officer on malaria in the city, the principal speakers were Sir Bhalchandra Krishna, Dr. Sukhia, Dr. Master and Dr. Dadachanji, and all medical practitioners. The motion before the meeting was for the appointment of a committee to consider the action to be taken for the eradication of the scourge. Dr. Sukhia said he admitted that malaria had taken a firm hold among the Parsis. Fever was rampant, particularly among Parsis of the lower and middle classes, but while he agreed with Dr. Bentley to that extent, he thought the figures he had given to show the incidence of spleen index were open to correction. It seemed to him that Dr. Bentley applied himself to his work with a preconceived notion that the Parsis suffered from malaria on account of wells in their houses. Perhaps

[1] *The Post-Graduate.* Vol. xxvi., No. 9. A monthly journal of medicine, surgery, and medical education. September, 1911. Second Avenue and Twentieth Street, New York City.

Dr. Bentley was not aware that these were very old wells. In his opinion the works at the new docks and similar excavation works undertaken in the past were the chief cause of the severe outbreak of malaria in 1908 and in previous years.

"Mr. Mistry thought Dr. Bentley's report was intended to whitewash the report of the special commission appointed by the Government of India at Mian Mir, Sir Balchandra Krishna said that as the outbreak of malaria in the city was chiefly due to the operations of the Port Trust and partly to the works of the Great Indian Peninsula and the Bombay, Baroda and Central India Railways, those bodies should also be called upon to contribute substantially to the cost of the measures to be taken for stamping out malaria. Dr. K. E. Dadachanji also disagreed with Dr. Bentley in his charge against the wells as the chief cause of the spread of malaria. The cause of the outbreak was the excavations. He moved a rider that the committee be empowered to call for the documents on which Dr. Bentley's report was based, and to examine witnesses. This rider was accepted by Dr. Master.

"Mr. D. P. Vacha said, Dr. Bentley had taken the well theory as a foregone conclusion and based his remarks upon it, which no scientific man would do. He considered Dr. Bentley's conclusion perfectly worthless and also looked upon the statistics given by him with entire suspicion. When plague first broke out, a variety of theories were put forward and were ultimately proved to be worthless by the Plague Commission, and the enormous expenditure which the Corporation had incurred on plague measures had been thrown away. Dr. Bentley suggested a statutory obligation allowing an inspector to enter the house of any individual and force him to do things as he might suggest. This was a power which even the municipality did not possess. Dr. Bentley perhaps did not know what it meant to give such statutory powers. It would lead to riots and to the ruin of Bombay, and he appealed to the members of the Legislative Council and especially their own representative, Sir Pherozeshah Mehta, to take a firm stand against the passing of such a measure.

"Mr. Cowasji Jehangir failed to understand why certain members thought that it was an insult to the Parsi community to say that they suffered from malaria more than any other community. He had gone through the whole report of Dr. Bentley, and it did not seem to him that he was acting with a preconceived idea He also did not see that there was any kindness in telling people that wells had nothing to do with the spread of malaria."

This is the sort of thing scientific men have to put up with; and is it any wonder that sanitary science stagnates when ignorance of the type here betrayed is allowed to declare itself and go uncontradicted.

Apart from many of the remarks being absolutely worthless, many of them are impertinent to a degree and evidently based on personal spite to Dr. Bentley and his work. It will be interesting to see what part the Government who appointed Dr. Bentley will now take in the matter.

*Anthelmintic Drugs.*—Schultz in a paper read before the Section of Pharmacology and Therapeutics of the American Medical Association, at the sixty-second annual session held at Los Angeles in June, 1911, and re-published in the *Journal of the American Medical Association* for September 30, 1911, takes up the study of the relative efficiency and danger of thymol as compared with certain other remedies proposed for the treatment of ankylostomiasis. After a prolonged investigation he concludes that:—

(1) Any practical vermifuge to be effective in expelling uncinaria or ankylostoma must be an irritant of sufficient intensity to cause the parasite to loosen its hold.

(2) It should paralyze the neuromuscular apparatus to hinder the parasite from making fresh attachment.

(3) Its relative toxicity for the parasite must be either much greater than that for the host or be much more readily absorbed by the former than by the latter.

As he points out in his paper drugs for ankylostomiasis are absorbed more or less from the ailmentary tract, and Tenholt has even gone so far as to assume that only such drugs as are absorbed can be active in expelling the ankylostoma. Since the parasites take food by way of the mouth they must of necessity be poisoned by ingesting the tissues of the host already impregnated with the toxic substance, and if the host does not absorb sufficient thymol, beta-nephthol, male fern, &c., they remain fixed to the intestinal mucosa and are not expelled by the purgative.

His experimental data suggest that this is at best only a part of the truth. It happens that drugs like thymol, when combined with iodine or the benzole radicle, are much less active vermicides than thymol itself. It is also true that thymol iodide, being much less soluble than thymol, is absorbed to a less extent by the intestinal mucosa. *A priori* this would seem to support the idea of Tenholt that thymol iodide has no action on hookworms because none of the drug is absorbed by the host. But if the worms themselves be studied in contact with solutions each of thymol and thymol iodide it is possible to explain the reaction of the worms towards the two drugs on the basis of amount of drug in actual contact with the parasite and the effect of introducing the iodine atom into the molecule, and thus lowering its toxicity. While, therefore, the drug absorbed by the host and ingested by the parasite as a part of the cell and plasma may have a toxic action on the worms, it seems that such drugs as thymol, male fern, chloroform, and beta-naphthol act by direct contact with the worms, causing rapid vermiform movements, and if the irritation is sufficiently great the worms finally attempt to escape. From now on until paralysis sets in not a little of the surrounding media is ingested, since the mouth parts of the parasite are kept in constant action. At this stage the intestinal contents of the host ought to be expelled so as to get rid of the surplus drug and the poisoned or anæsthetized worms. Judging from the action on the worms *in vitro*, two to three hours seem to be about the time when the

cathartic should begin its work. Although in the case of chloroform and eucalyptus the cathartic in the form of castor oil works hand in hand with the chloroform.

In conclusion Schultz believes that at present thymol is one of the most toxic vermicides for ankylostoma thus far proposed. It is easy to obtain, keeps well, is cheap, and is easily administered; it kills the parasites instead of merely paralyzing them. When taken under the care of a physician who is careful to gauge the dose in accordance with the physical condition of the host, it seems to be the best all-round remedy thus far studied. While dangerous in large doses, it differs from beta-naphthol, male fern, and chloroform in that the danger is at once apparent and can be controlled by heart stimulants and by methods that help to maintain a good blood-pressure until the drug has killed the parasite and the cathartic has removed the excess of thymol. Whereas with the other remedies just mentioned the danger signals are less obvious, and usually it is only after irreparable danger is done that one is aware that the patient is in danger of any after-effects.

Beta-naphthol is probably the next pure chemical substance that ought to be tried more extensively on human hookworm subjects. Persons affected with kidney lesions ought not to take it, and when used the urine should be examined to determine whether it causes albuminuria. If the maximum dosage of 2 to 4 gm., divided in two parts and given an hour apart, does not cause renal disturbances in adults, beta-naphthol has much to recommend it as a hookworm remedy.

Male fern at present has not much promise in America because of the lack of care in collecting the rhizome and in preparing an active ethereal extract. This, however, is a condition which doubtless would soon be remedied if once considerable demand existed for an active extract.

At present Schultz states that there is little reliable data on how efficient "Hermann's Mixture" is for expelling human hookworms, or what percentage of cases might show after-effects. He believes that it is unnecessary to add such an irritating oil as eucalyptus globulus, and if chloroform is used it ought to be given with plenty of oil. It is best to divide the maximum 3 c.c. dose, for a vigorous adult, into 3 parts, 1 c.c. of chloroform to 10 c.c. of castor oil, given at hour intervals. Should vomiting occur before the chloroform is taken, the treatment is to be stopped, and if necessary changed to thymol or beta-naphthol. By thus regulating the dose of chloroform, Schultz has had excellent results with dogs, the drug has proved rapid in its action and thus far has not been followed by any evil after-effects. Should the chloroform castor oil mixture act as favourably in human beings as it has in dogs, it should prove a universal worm remedy of great importance.

# Notices.

## FAR EASTERN ASSOCIATION OF TROPICAL MEDICINE.

SECOND BIENNIAL CONGRESS, HONG KONG.

*January* 20 *to January* 27, 1912.

*President.*—J. Mitford Atkinson, M.B., D.P.H., Hong Kong.

*Vice-Presidents.*—W. G. Ellis, M.D., Straits Settlements; J. de Haan, M.D., Java; Victor G. Heiser, M.D, Philippine Islands; H. Campbell Highet, M.D., D.P.H., Siam; Neil Macleod, M.D., Shanghai; Sir Allen Perry, M.D., D.P.H., Ceylon; Professor G. Shibiyama, M.D., Japan; J. Staby, M.D., Tsingtau; Professor Yersin, M.D., French Indo-China.

*Secretary.*—Francis Clark, M.D., M.R.C.P., D.P.H., Hong Kong.

DEAR SIR,—The Second Biennial Congress of this Association will be held in Hong Kong, from Saturday, January 20, to Saturday, January 27, 1912, and you are cordially invited to attend and to take part in the work of the Congress. The Association is an International one, formed to promote the Science and Art of Tropical Medicine in the Far East.

Saturday, January 20, will be devoted to the reception of official delegates and visitors, leaving the whole of the following week for the scientific work of the Congress.

The papers offered will be classified, so as to give, as far as possible, a day to each of the following groups of subjects: — protozoology, helminthology, cholera, plague, leprosy, tuberculosis, tropical fevers (including malaria), beri-beri, dysentery, surgery, obstetrics, infantile diseases, climate, hygiene, sanitation.

The following practitioners have already expressed their intention to submit papers, and other members of the medical profession in the Far East who are willing to introduce subjects for discussion are requested to communicate at once with the Secretary. Papers may be read in either English, French or German, but authors are asked to send a brief abstract in English in all cases.

J. Mitford Atkinson, M.B., D.P.H., Hong Kong: Presidential Address: "The Progress of Tropical Medicine during the past Twenty-five Years."

J. C. Dalmahoy Allen, M.D., Hong Kong; "Blood-pressure."

Professor Cheng Hao, Canton Army Medical School, Official Delegate from the Government of China: Subject not yet announced.

Major Weston P. Chamberlain, M.D., Chairman of the United States Army Board for the Study of Tropical Diseases as they Exist in the Philippine Islands: (1) "Prevention of Beri-beri among the Philippine (Native) Scouts by the Use of Undermilled Rice:" and in conjunction with Captain Edward B. Vedder, M.D.: (2) "The Substance in Rice Polishings which Prevents Polyneuritis Gallinarum and Beri-beri."

Lawrence G. Fink, M.B., Burma; "Blackwater Fever in Burma."

George A. Finlayson, M.A., M.B., M.R.C.P., Official Delegate from the Government of the Straits Settlements: Subject not yet announced.

H. Fraser, M.D., D.P.H., Official Delegate from the Government of the Federated Malay States, Director of the Institute for Medical Research, Kuala Lumpur: Subject not yet announced.

Paul C. Freer, M.D., Ph.D., Official Delegate from the Government of the Philippine Islands: "Results of the Past Two Years' Work in the Study of Tropical Sunlight."

G. Montagu Harston, M.D., Hong Kong: (1) "The Care of Children in the Tropics." (2) "The Care of the Eyesight in the Tropics."

Victor G. Heiser, M.D., Official Delegate from the Government of the Philippine Islands: "Beri-beri."

C. Montague Heanley, M.B., D.P.H., Hong Kong: "The Laboratory Diagnosis of Syphilis."

Major S. P. James, M.B., D.P.H., I.M.S., Official Delegate from the Government of India: Subject not yet announced.

Gregory P. Jordan, M.B., Hong Kong: "Carbon Dioxide Snow: its Use in Private Practice in the Tropics."

J. M. Swan, M.D., Canton: "Some Rare Conditions which have been met with in the Treatment of Vesical Calculi in South China."

Richard P. Strong, M.D., Ph.D., Official Delegate from the Government of the Philippine Islands: (1) "Immunization against Pneumonic Plague." (2) "The Etiology of Beri-beri."

H. Gordon Thompson, M.D., F.R.C.S., Pakhoi: "Surgical Work in South China."

Captain Edward B. Vedder, M.D., United States Army Medical Corps, Manila: "An Experimental Study of the Action of Ipecacuanha on Amœbæ."

G. Duncan Whyte, M.B., Swatow: "Tuberculosis in South China."

C. Noel Davis, M.B., D.P.H., Shanghai: "Beri-beri."

The subscription to the Association is 10s. 6d. (6 dollars Hong Kong currency) and is due now (1911), but no further subscription will be required until 1913.

A suitable social programme is being arranged for the entertainment of visitors during the Congress.

I am, Sir,

Yours very faithfully,

FRANCIS CLARK, *Secretary.*

*Hong Kong, September* 5, 1911.

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EXAMINING BOARD IN ENGLAND BY THE ROYAL COLLEGE OF PHYSICIANS OF LONDON AND THE ROYAL COLLEGE OF SURGEONS OF ENGLAND.

*Diploma in Tropical Medicine.*

This Examination will commence on Monday, October 23, 1911. Candidates who have completed the prescribed courses, and who desire to present themselves for this Examination, must forward the necessary certificates through the post to the Examination Hall, West Door, Victoria Embankment, London, W.C., at once.

FREDERIC G. HALLETT, *Secretary.*

*October* 1, 1911.

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## Notes and News.

THE Examining Board of the Royal College of Physicians and Surgeons of England has decided to grant a Diploma in Tropical Medicine, and the first examination will be held on October 23, 1911. The rapid progress that Tropical Medicine has made in the last ten years necessitates such a recognition, and the College, by granting such a diploma are only, after all, falling into touch with Cambridge, Edinburgh and Liverpool, who have, for years back now, given such an honour. Intending candidates will find an excellent course on Tropical Medicine awaiting them at the London School of Tropical Medicine, Albert Docks, E., where large numbers of the holders of the Cambridge Diploma have already been trained. For men proceeding abroad, especially into the Services, both a diploma in Public Health and Tropical Medicine will be found of the greatest value later on, and these awards are generally most easily obtained just after the student has completed his course at one of the Tropical Schools, that is to say, when he has his knowledge, so to speak, at his finger tips.

All interested in the subject should remember this, and should certainly try and take one or other of the diplomas in Tropical Medicine. A notice printed in another part of the Journal indicates that names for the October examination of the College must be given in at once.

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## Recent and Current Literature.

*A list of recent publications and articles bearing on tropical diseases is given below. To readers interested in any branch of tropical literature mentioned in these lists the Editors of the* JOURNAL OF TROPICAL MEDICINE AND HYGIENE *will be pleased, when possible, to send, on application, the medical journals in which the articles appear.*

**"British Medical Journal," October 7, 1911.**

*Dermatitis produced by Satinwood.*—Professor Cash, Regius Professor of Materia Medica in the University of Aberdeen, contributes a very interesting article on the dermatitis produced by East Indian satinwood ("*Chloroxylon Swietenia*") in the above number of the *British Medical Journal*. At one time he says considerable doubt existed as to whether both East and West Indian satinwoods possessed irritant properties, and were equally active; but his examination of the substances isolated from both woods submitted to him from the Imperial Institute indicates that the East Indian wood is the more active, and is probably the usual cause of the satinwood dermatitis. This conclusion is in harmony with that stated in the

Annual Report of the Chief Inspector of Factories for 1907, and arrived at as the result of an inquiry by inspectors of factories in workshops using both kinds of satinwood in the United Kingdom. The dermatitis produced is of an erysipelatoid character, the surface becoming moist in places, and subsequently desquamating. The author gives details of a case described by a Dr. Jones, in which not only the hands and wrists, but the face and neck of a joiner in a Govan workshop showed an acute inflammatory condition of erysipelatoid character, but without concomitant sickness or fever. Improvement followed on suspension of work, but a return to the workshop caused a speedy reappearance of the symptoms. The first attack was slow in developing (six weeks after first handling the wood), but relapses were rapid after recovering from the initial disorder, and return to work. Again, Dr. Gardiner saw a papulo-vesicular rash on the backs of the hands extending to the forearms, and a condition of the face and neck at first strongly suggestive of erysipelas in another case who had handled satinwood. Removal from working with the wood is the treatment required.

**"Annals of Tropical Medicine and Parasitology," August 1, 1911, Series T. M., vol. v., No. 2.**

*Blackwater Fever.*—Yorke and Nauss conclude after an experimental investigation into the mechanism of the production of suppression of urine in blackwater fever that under certain conditions the mere passage of hæmoglobin through the kidneys of a healthy animal is sufficient to cause suppression of urine, owing to occlusion of the lumen of the renal tubules by plugs of granular material derived from the hæmoglobin. The process is considerably facilitated by any factor which tends to lower the blood pressure of the animal, and, as a result, the secretion of water by the Malpighian capsules. On the other hand, when the blood volume of the animal is kept up, a large amount of hæmoglobin may be injected without any tendency to suppression of urine.

**"The Journal of the American Medical Association," September 30, 1911.**

*Ankylostomiasis.*—Gunn, of San Francisco, deals with ankylostomiasis in California, its importation, dissemination, and prevention being discussed. He believes that hook-worm disease has been extensively imported into California in the past; (2) that it is still being largely imported at the present time; (3) that the deep gold mines of the State are as badly infected as many of the European mines; (4) that in all probability some of the rural districts, if examined, could be demonstrated to be infected; (5) that the only preventive measures employed are being taken by the Federal authorities, and these are totally inadequate, as they are in operation in only one immigration station; and, further, do not cover a large class of people who bring in the infection.

## Personal Notes.

INDIA OFFICE.

*From September 11 to October 9.*

*Arrivals reported in London.*—Major G. P. T. Groube, I.M.S.; Lieutenant-Colonel B. C. Oldham, I.M.S., B.; Captain E. A. Walker, I.M.S., B.

*Extension of Leave.*—Captain J. F. James, I.M.S., 4 days.; Major J. W. F. Rait, I.M.S., B., 4 m.; Captain N. S. Wells, I.M.S., B., 4 m., M.C.; Captain J. W. McCay, I.M.S., B., 1 m. M.C.; Captain E. T. Harris, I.M.S., 4 m.; Major C. E. Williams, I.M.S., B., 14 days; Captain J. W. McCoy, I.M.S., B., 2 m., M.C.; Surgeon-General H. W. Stevenson, I.M.S., 5 days; Major A. H. Moorhead, I.M.S., 3 m.; Captain W. L. Trafford, I.M.S., 9 m.; Captain C. H. Reinhold, I.M.S., 14 days.

*Permitted to Return.*—Major J. W. F. Rait, I.M.S., B.; Captain N. S. Wells, I.M.S., B.; Major F. L. Blenkinsop, I.M.S.; Captain E. A. Roberts, I.M.S.; Lieutenant A. W. Sadlier, I.M.S.; Captain W. E. Brierley, I.M.S.; Major D. N. Anderson, I.M.S.

LIST OF INDIAN CIVIL OFFICERS ON LEAVE (INCLUDING MILITARY OFFICERS UNDER CIVIL RULES).

*Showing the Name, Province, and Department, and the Period for, and Date from, which the Leave was granted.*

Browne, Captain E. W., I.M.S., M.

Dick, Major M., I.M.S., Burma, 6 m., July 24, 1911.

Oldham, Lieutenant-Colonel B. C., I.M.S., B., 15 m., August 11, 1911.

Stuart, A. E. C., C.S.I., M. Cov., Member Board of Revenue, M., 12 m., Nov. 18, 1910.

LIST OF INDIAN MILITARY OFFICERS ON LEAVE.

*Showing the Name, Regiment, or Department, and the Period for which the Leave was granted.*

Groube, Major G. P. T., I.M.S.

## EXCHANGES.

American Journal of Surgery. Annali di Medicina Navale. Annal d' Igiene Sperimentale. Archiv für Schiffs u. Tropen-Hygiene. Archives de Médecine Navale. Archives de Parasitologie. Archives of Internal Medicine. Archives Russes de Pathologie, de Médec. Australasian Medical Gazette. Boletin de Medicina Naval. Boston Medical and Surgical Journal. Bristol Medico-Chirurgical Journal. British and Colonial Druggist. British Journal of Dermatology. British Medical Journal. Brooklyn Medical Journal. Bulletin Médical de l'Indo-Chine Française. Caducée. Clinical Journal. Clinique et de Bacteriologie. Gazetta Internazionale di Medicina, Chirurgia, Igiene. Giornale Medico del R. Esercito. Hong Kong Telegraph. Il Policlinico. Indian Medical Gazette. Indian Medical Record. Indian Public Health. Interstate Medical Journal. Jahresbericht. Janus. Journal of the Royal Army Medical Corps. Journal of Laryngology and Otology. Journal of the American Medical Association. Journal of Experimental Medicine. Journal of Tropical Veterinary Science. La Grèce Médicale. Lancet. Liverpool Medico-Chirurgical Journal. London and China Express. Medical Brief. Medical Missionary Journal. Medical Record. Medical Review. Merck's Archives. New York Medical Journal. New York Post-Graduate. Pacific Medical Journal. Philippine Journal of Science. Polyclinic. Revista de Medicina Tropical. Revista Medica de S. Paulo. Sei-i-Kwai Medical Journal. The Hospital. The Northumberland and Durham Medical Journal. Transactions of the American Microscopical Society. West India Committee Circular, West Africa. New York State Journal of Medicine.

## Notices to Correspondents.

1.—Manuscripts sent in cannot be returned.

2.—As our contributors are for the most part resident abroad, proofs will not be submitted to those dwelling outside the United Kingdom, unless specially desired and arranged for.

3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.

4.—Authors desiring reprints of their communications to the JOURNAL OF TROPICAL MEDICINE AND HYGIENE should communicate with the Publishers.

5.—Correspondents should look for replies under the heading "Answers to Correspondents."

## Original Communications.

# A PRELIMINARY REPORT ON A METHOD FOR PREVENTING THE DEVELOPMENT OF PERNICIOUS MALARIA.*

By W. M. James, M.D.

*Ancon Hospital, Ancon, Canal Zone, Panama.*

In malaria, when a certain symptom or a symptom-complex manifests itself to such an extent that life is endangered, the type of disease so produced is called pernicious. Although there are many varieties of pernicious malaria, all have a common etiology, which depends upon the localization of the parasites or the toxic products of these in certain organs, or upon the effect of an overwhelming production of toxin on the entire organism. In this report I refer to æstivo-autumnal malaria and its parasite, unless otherwise noted.

The examination of the peripheral blood is, perhaps, the only practical method by which the probable development of pernicious symptoms may be foretold. And this method is not perfect, for the examination may be made at a time when the greater number of parasites has withdrawn to the local circulation in various internal organs; and, not infrequently, of two infections which exhibit in the peripheral blood an equally large number of parasites, one yields readily to quinine while the other gives rise to grave symptoms, with death. Also, immunity is a very important agent in determining the result of an infection; for example, often negroes bear with slight discomfort an infection that, as far as the number of parasites is a criterion, results in severe disturbance in Caucasians.

However, these limitations are more frequently hypothetical than real; and certainly one may be sure that if a great number of parasites are present in the peripheral circulation, at least an equally great number are in the internal organs. Pernicious symptoms seldom develop unless prior to their manifestation there has been a notable increase of the parasites in the peripheral blood. There is one exception to this statement, and I shall refer to it later. As a rule such symptoms appear at the beginning of the latter half of the cycle. Earlier, the presence of very many young forms, and the occurrence of segmenting bodies and a large proportion of multiple infected erythrocytes, are true and certain signs of impending danger that afford indications for prompt and vigorous treatment, even if the physical and mental condition of the patient be satisfactory.

If there is to be success in the prevention of pernicious malaria, the possibility of the development of the condition must be recognized. In the occurrence in the peripheral blood of very many parasites there is ever present a potential pernicious infection, whose development, while it cannot be always predicted, will unfailingly follow in a certain proportion of cases, no matter how satisfactory the condition of the patient, nor how frequently a successful result has followed the administration of quinine by the usual methods and in the usual doses, in other infections of equal intensity. And if the pernicious symptoms become well established, recovery is rare, for the very simple reason that the older parasites, which block the capillaries and the liberation of toxin from the sporulating forms, are not at all amenable to the action of quinine. This homely fact is not infrequently overlooked by many writers on malaria, in that the doses of quinine advocated by them, and the methods of exhibiting the drug, as put forward in not a few articles and text-books, are indeed not sufficient to prevent the development of pernicious symptoms, still less to effect a cure of the condition responsible for them, as I shall attempt to demonstrate.

It is not possible to lay down a hard and fast rule in regard to the number of parasites that should be regarded as dangerous; the personal equation enters largely into such recognition, and experience and individual judgment are the best guides. Personally, I look upon an infection of 200,000 parasites per c.mm., or about one to twenty or twenty-five erythrocytes, with suspicion, and I do not hesitate to treat vigorously heavier infections by the method that I shall presently advocate. Particularly if doubly infected erythrocytes are present in the proportion of 5 per cent. or more of the total of the infected cells, is the infection to be regarded as dangerous, even if the number of parasites be not so high as above stated.

If the infection be uncomplicated by organic disease, or by another malady which is evident to such extent that one cannot say from the clinical symptoms which determined the fatal issue, death due to malaria occurs in one of four ways:—

(1) Blocking of the capillaries of some vital organ, most frequently those of the brain, by erythrocytes containing parasites to such an extent that the organ can no longer perform the functions necessary for life.

(2) The simultaneous or continuous sporulation of healthy parasites in numbers sufficient to overwhelm the organism with the toxin thus liberated.

(3) A combination of both of these methods, by which a vital organ may so have had its function impaired by a partial blocking of the capillaries that a relatively small amount of toxin liberated by sporulating parasites proves fatal.

(4) A cause not hitherto determined, but probably the failure of the organism to eliminate the toxin formed, when neither clinically nor at autopsy does the quantity of the infection seem to have been sufficient to cause death.

It is with the prevention of death due to the

* Read before the Canal Zone Medical Association, September 13, 1911, and published by permission of Col. W. C. Gorgas, Chief Sanitary Officer, Isthmian Canal Commission.

first three causes that this report has to do. I have no information to offer as to the prevention of death due to the fourth. Cases in this class are not infrequent on the Canal Zone, but it is not possible to foretell the appearance of the pernicious symptoms, which for the most part are cerebral; when these develop all treatment directed against malaria fails.

That type of malaria known as the "comatose pernicious" is particularly dangerous. In this the autopsy shows a blocking of the cerebral capillaries with immature parasites. Sometimes, in other forms, death occurs from toxæmia; in such cases the patient's mind is often clear until shortly before death, which apparently occurs from poisoning of the nervous centres that govern respiration and cardiac action, and the clinical picture is similar to that seen in many fatal cases of pneumonia. In this form of infection the autopsy slides show sporulating parasites, and the capillaries of the brain and other organs may or may not be blocked. In such cases there is often a very regular distribution of the plasmodia throughout the body. In this latter class might be placed also those infections that show many sporulating parasites in the capillaries of the brain, and very young forms in excess in other organs.

It is obvious that if such occurrences are to be successfully prevented, the physician must inhibit:—

(*a*) *The blocking of the capillaries by the parasite-infected erythrocytes*, and

(*b*) *The simultaneous sporulation of a great number of parasites.*

Only very seldom, and then in most intense infections, are the cerebral capillaries blocked by red-blood cells containing the youngest forms of the plasmodia. Generally these are half-grown, or older, so that it appears that the metabolic activity of the parasites is one of the factors in whatever mechanism it is that brings about capillary blocking.

Further, there is much evidence to show that if the vitality of the parasites can be impaired to a sufficient degree, they will not so affect the erythrocytes containing them as to cause occlusion of the capillaries.

And, in æstivo-autumnal malaria, if the parasites are sufficiently affected by quinine, sporulation will not take place *en masse*, but will extend over a period prolonged for one to three days, so that the organism has sufficient opportunity to deal effectively with the toxin liberated.

I shall not attempt at present to prove these propositions, as the evidence to support them will be presented in full in a later communication. As a result of over two years' study of clinical cases and autopsy slides, I believe that the propositions are in a great part true, although sometimes exceptions have been noted. When death has been due to one of the first three causes mentioned, it is evident that an amount of quinine sufficient to inhibit successfully the growth or the sporulation of the parasites has not entered into the circulation, although that which has entered, I have frequentely observed at autopsy, has had a pronounced effect on the activities of the plasmodia. The rate of growth of the parasites has been decreased decidedly; the formation of pigment and chromatin markedly lessened; and sporulation has been prolonged and atypical. From these data it is legitimate to infer that had the action of the quinine been more powerful, the injury to the parasites would have been correspondingly increased.

The possibility of the development of pernicious symptoms in heavy infections has been fully recognized in the past by the physicians in Ancon Hospital. Following the teaching of authorities on malaria, such as Marchiafava and Bignami, Mannaberg, Osler, Ross, and others, and also that of our own experience, we have endeavoured to prevent perniciousness by the early administration of quinine, hypodermically or by the mouth, in initial doses of 20 to 30 gr., and further doses of 10 to 20 gr. every four hours, until the paroxysm passed. We used intravenous injections only when these were urgently indicated, and not for preventive purposes. In many cases this treatment has been successful; but not infrequently pernicious symptoms developed in spite of it, and death followed.

But until recently we were at a loss for a method whereby more quinine might be quickly directed against the parasites. The rate of absorption from hypodermic injections of the usual dilution of 1:2 or 1:3 was recognized to be slower than from any other methods of giving the drug; nausea and vomiting in many of these cases precluded oral administration; and intravenous injection after the method of Bacelli in dilutions of 1:10 (1 grm. to 10 c.c.) we found to be dangerous and not satisfactory. I have witnessed two deaths that followed immediately the injection of quinine according to this method, when the dose, dilution, and manner of administration recommended by Bacelli were carefully observed, and air embolism could be excluded. Even when larger doses were given by mouth or hypodermically, or both, at the beginning of the cycle, fatalities have followed. The reason for the want of success in such instances has appeared to me to be due to failure on the part of the organism to absorb properly and so transmit to the blood-stream the necessary amount of quinine to inhibit sufficiently the growth of the parasites. I have observed, in smears taken from the placenta in cases of abortion during a moderately acute malarial attack, that the adult parasites were much deformed, and sporulation was irregular and incomplete, when only ten grains of quinine three times per day had been exhibited for two days preceding the abortion. Such smears have a great advantage over autopsy preparations, in that they demonstrate the true appearance of adult parasites in the internal circulation.

Although I am aware that the parasites in certain

infections are much more resistant to the action of quinine than are those in others, and that in the same infection there are plasmodia which appear to be unharmed when the others are much damaged, it is my belief that if enough quinine can be thrown into the circulation at the beginning of the cycle, the very young parasites will be so affected that the subsequent paroxysm may be in great part aborted.

In the January (1911) number of *Paludism*, which is the Transactions of the Committee for the Study of Malaria in India, is a summary of a recent thesis on "Quinine and Its Salts; Their Solubility and Absorbability," by Captain A. C. MacGilchrist, M.A., M.D., I.M.S., which, in my opinion, explains very clearly the failure of large doses of quinine administered by the usual methods to prevent the onset of pernicious malaria. I give below quotations from this summary.

"*Compatibility of Quinine Salts with Blood-serum.*—Experiments on this subject were made to obtain information of what actually happens when solutions of quinine salts are injected subcutaneously or enter the blood-stream. The chief results were as follows: The salts of quinine most soluble in water, even in a dilution of 1 to 100, are not miscible with blood-serum. The three salts commonly used for subcutaneous injection, namely, quinine bi-hydrochloride, quinine bi-hydrobromide, and quinine urea, when prepared in a strength equal to that most frequently employed for hypodermic administration and then mixed with an equal volume of ox-blood-serum, produce in a few minutes a solid gelatinous mass. The bi-hydrobromide salt, even in a dilution of 1 in 20, produces a curdy mass. The deposit which forms *in vitro* when a concentrated solution of a quinine salt is added to blood-serum contains quinine in altered form, oxidized and combined with proteid. When equal volumes of blood-serum and quinine hydrochloride (1 in 20) are mixed together, slightly over one half of the quinine is dissolved, and slightly under half remains in the deposit; the greater the dilution of the quinine salts the less the deposit that occurs on mixing with blood-serum. Quinine salts in the dilutions usually employed are quite unsuitable for hypodermic use."

Captain MacGilchrist then details the results of oral administration, and places stress on the marked influence of affections of the gastro-intestinal tract and liver in reducing the amount of quinine absorbed when the drug is given by the mouth. As such affections very frequently complicate severe malaria, the failure of the drug when orally exhibited in such instances is easily explained.

"*Subcutaneous (including Intramuscular) Administration.*—Solutions of quinine salts in the concentration usually employed for hypodermic injection produce, when mixed with blood-serum, a coagulum which contains quinine in altered form. Quinine is precipitated at the site of intramuscular injections as usually carried out. The amount of quinine eliminated in the urine after subcutaneous administration varies between wide limits. Urethane, antipyrine, and sodium chloride, although they increase the solubility of quinine hydrochloride in water, do not increase the miscibility of the salt with ox-blood-serum; and the new compounds formed in such solutions are of doubtful therapeutic value.* In experiments on animals, the absorbability of quinine by the several modes of administration is in the following order: (1) Subcutaneous injection in extreme dilution (1 in 150); (2) oral administration during fasting; (3) oral administration with, or immediately after, food; (4) subcutaneous injection in the strengths generally used for that method (1 in 2 and 1 in 8). For clinical reasons, subcutaneous injection in extreme dilution cannot, of course, be employed. Oral administration affords more prompt action of the alkaloid than subcutaneous (in small dilutions),† and the latter method is followed by various complications and dangers. Moreover, quinine and its salts are fundamentally unsuited for hypodermic use.

"*Intravenous Administration.*—Great dilution (at least 1 in 150) is necessary in order to avoid the dangers special to quinine. Seven grains of quinine bi-hydrochloride should be dissolved in two or three pints of saline. This mode of administration is called for in cases of emergency, as in pernicious malaria with coma or other cerebral symptoms; and in such cases the extreme dilution affords the additional advantage of attenuating the toxins and favouring their elimination. In this dilution intravenous injections of quinine are quick and sure, and their action is not fleeting. They are attended by no risks peculiar to quinine, but only by those attendant on intravenous infusions generally."

After reading the observations of Captain MacGilchrist, I was firmly convinced that the failure of quinine in large doses in certain cases in which the drug had been administered early in the cycle was due to improper administration. Either the assimilation of the alkaloid or its salts from the intestinal tract was impaired by reason of the infection, or the conditions described as occurring at the site of the injection were sufficient to prevent the proper absorption. In fact, it is no more than reasonable to suppose that when quinine is given hypodermically, less of the drug is quickly absorbed from large doses than from small ones: since the coagulum, with resulting tissue irritation, would be more readily handled by the body tissues and the lymphatics when small doses are given, a circumstance that perhaps would explain why the larger doses have not been more effective than the smaller.

I must, however, take exception to Captain MacGilchrist's statement that "for clinical reasons, subcutaneous injection in extreme dilution cannot,

* I do not think that, in this place, Captain MacGilchrist refers to the greater dilutions of quinine in a normal solution of sodium chloride, which he subsequently mentions.

† The parenthesis is mine.

of course, be employed." It is because quinine can be given in this way with no more discomfort to the patient than by the hypodermic method, and with far quicker and better results, that I place this preliminary report before physicians in the malarial countries for their consideration.

With the consent of Dr. W. E. Deeks, Chief of Medical Clinic in Ancon Hospital, I determined to try the subcutaneous administration of quinine as a preventive measure in intense infections, beginning with somewhat smaller dilutions than 1 to 150, and working up to that strength, and at the same time to use large doses. I have since used this method in twelve cases, giving 30 to 45 gr. as the initial dose, and repeating the doses in equal amounts or less at intervals of four to eight hours, according to the severity of the infection.

In four of these cases at the time of admission of the patient a very great number of young parasites, with segmenting forms and multiple infected erythrocytes, was found in the peripheral blood. In six cases there were heavy infections with young plasmodia, and quite a number of doubly and trebly infected red-blood cells. In two cases moderate infections with tertian parasites were found, but in one the patient was delirious, and in the other comatose.

*Case* I.—Chart 1. Admission No. 102,213. A. C., Spaniard, age 49, twenty-two months in the Canal Zone. Admitted July 12, 1911. Several previous attacks of fever, one previous admission in February of this year for hernia. Patient is anæmic, poorly nourished, and under medium height. Has been ill six days with chills, fever, headache and constipation. Had taken quinine three days prior to admission.

Tongue, coated; eyes, conjunctivæ injected and jaundiced; liver, enlarged; spleen, palpable at costal margin; mental condition, good.

Blood examination: Very many small, non-pigmented æstivo-autumnal parasites; several segmenting forms, and many multiple infected erythrocytes. Not a few of the latter contained three and four parasites, and one with six was observed. (This was in a fresh specimen.)

On admission, quinine, 20 gr. by mouth, was given, and 10 gr. every four hours was ordered. At 8.30 p.m., 45 gr.* in 5 oz. of normal salt solution was given subcutaneously (1 to 50 dilution). Patient became hysterical while the saline and quinine was being administered, but did not complain of pain, and slept well until 4.30 a.m., when he vomited the 4 a.m. dose of 10 gr. of quinine. After this he was restless, and complained of headache.

July 13.—Blood examination, 9 a.m.: Very many parasites, with many doubly infected erythrocytes. The erythrocytes that contained more than two parasites had in great part disappeared. In the stained specimen the parasites were fragmented, and very irregular in shape. In the fresh specimen they were very actively motile, but fragmentation of many of them was plainly evident, and no pigment was seen. Later in the day the parasites lost their motility, and appeared as highly refractive unpigmented discs.

At 9 a.m. 45 gr., and at 5 p.m. 30 gr., each dose in 5 oz. of normal saline solution, were exhibited (1 to 50 and 1 to 75 dilation). Besides these doses the patient received the 10 gr. every four hours by mouth. At 7.30 and again at 8.30 p.m., he vomited. During the night he was semi-comatose, and passed urine involuntarily. Singultus was present also, but not severe.

July 14.—Blood examination: Very few parasites. These were round or oval in shape, about one-third to one-half of the diameter of the erythrocyte containing them in size, and contained no pigment and but scanty chromatin. Contrasted with normal parasites of this age they were much deformed. At 9 a.m. 45 gr. in 5 oz. of normal salt solution was given, and doses of 10 gr. three times a day by mouth ordered.

The patient was much better, and, except for a slight hysteria that persisted until convalescence was well established, improved rapidly.

Parasites similar to those found on the 14th were seen on the 15th and 16th, also a few young ring forms.

It should be noted that the patient passed through the prolonged paroxysm beginning on the 14th, and ending on the 17th, without symptoms other than those of a slight malarial attack. On the 12th, in both slide and thick film preparations, but one generation of the parasites was found, so that the fever of the 14th—17th, was very probably due to an irregular and protracted sporulation. Although the symptoms on the night of the 13th might be attributed to the very large amount of quinine exhibited, they were not at all different from those in the beginning of a pernicious attack, and were probably due to slight blocking of the cerebral capillaries.

*Case* 2.—Chart 2. Admission No. 103,571. Admitted July 29, 1911. C. A., Spaniard, age 15, fifteen months in the Canal Zone. Says this is first attack of fever. Ill one day, fever, no chill, headache, vomiting. One dose of quinine shortly before admission.

Tongue, coated; eye, conjunctivæ injected and jaundiced; liver slightly enlarged; spleen not palpable. A well-nourished boy, and not anæmic.

Blood examination: A heavy infection with young æstivo-autumnal ring forms, no segmenting parasites, and very few doubly infected erythrocytes.

On admission the patient was not regarded as seriously ill, and 15 gr. of quinine was given by mouth, and 10 gr. three times a day ordered.

July 30.—The patient was very ill, vomited continually, was delirious, and passed involuntary stools and urine. From the 30th to August 3 in-

* All quinine used in subcutaneous and intravenous injections was a French preparation of the bi-hydrochloride, .5 grm. in 2 c.c., in ampoules.

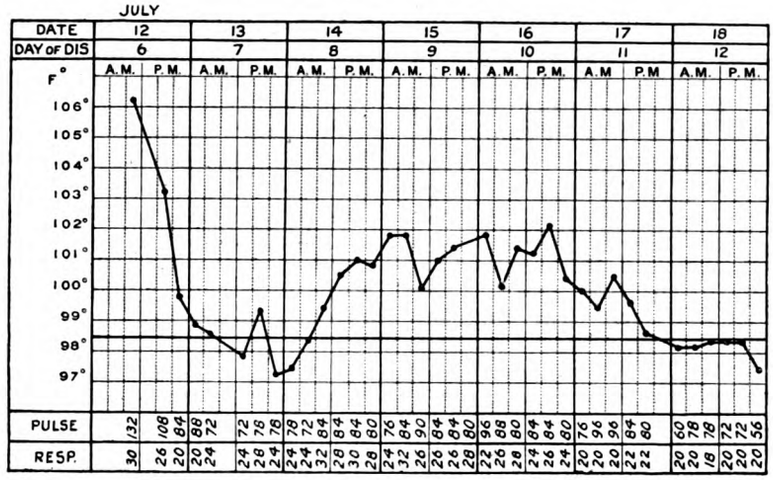
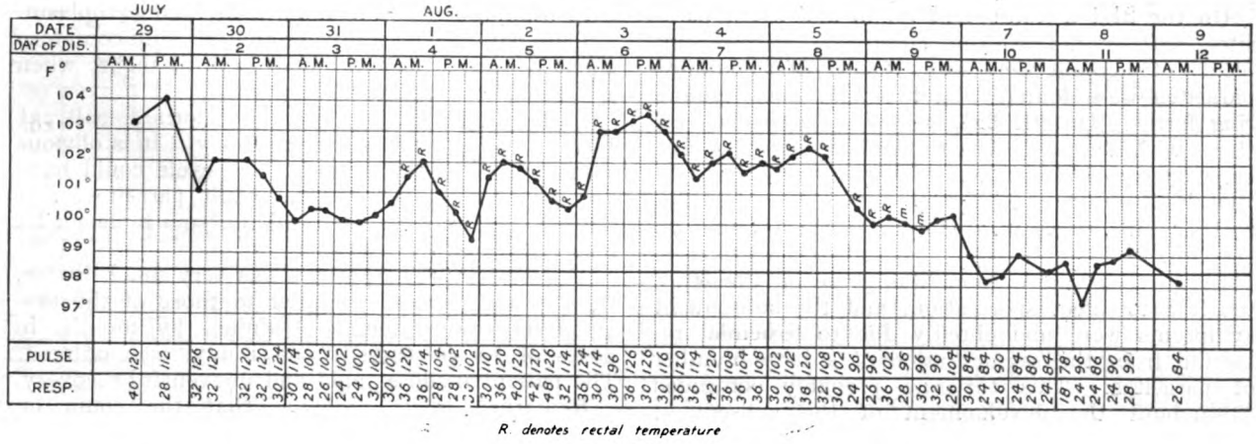



CHART 1.—A. C.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PULSE
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R denotes rectal temperature

CHART 2.—C. A.

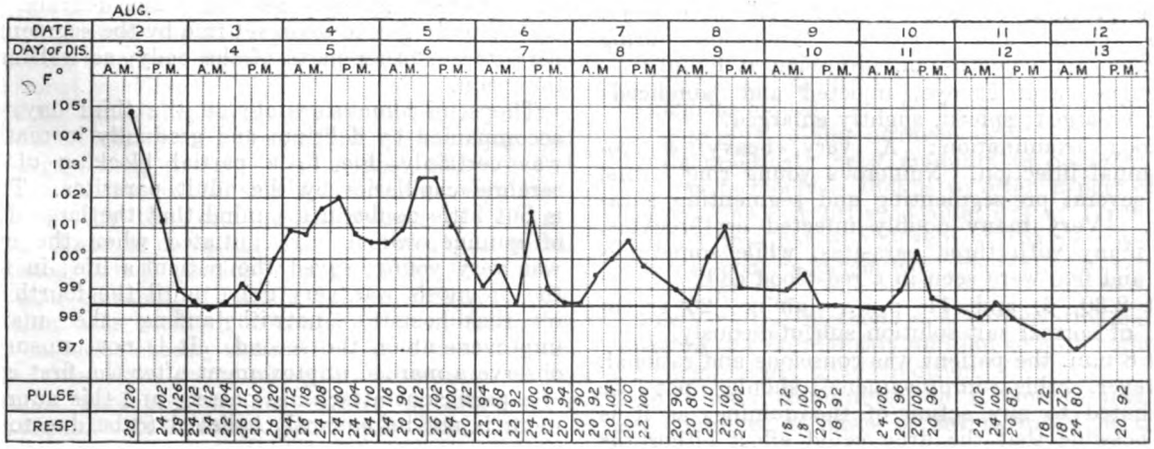


CHART 3.—R. R.

clusive, he was critically ill with no remission of the symptoms, and most of the time very delirious. This case belongs to the so-called "typhoid pernicious" class. On August 3 the symptoms were so suggestive of typhoid fever complicating the malarial infection, that a blood culture was taken and a Widal test made. Both of these were negative for typhoid and allied fevers.

On the 30th many parasites were found which were normal in appearance, many showing well-marked pigment. Young rings were found also, showing that a multiple infection was present.

Quinine, 20 gr. in 10 oz. of normal salt solution, was given subcutaneously at 9 a.m., and 15 gr. in 5 oz. at 8 p.m.

31st.—Quinine, 30 gr. in 10 oz., at 9 a.m.

August 1.—Quinine, 15 gr. in 5 oz. at 9 a.m.,

August 2.—Same dose as on 1st.

2 and 6 p.m.

August 3.—Quinine, 30 gr. in 8 oz. of normal salt per rectum. The injection was retained about twenty minutes, and later there was a marked abatement of the gastric symptoms, so that the patient could retain quinine by mouth.

On the 31st a number of round and ovoid parasites with well-developed chromatin and central blocks of pigment were seen. On the 1st, but few parasites were found. On the 2nd, many young ring forms. On the 3rd, very few parasites, and these with scanty chromatin and pigment. A few crescents were found on this date. On the 4th, parasites were found only by use of the thick film method, and these were similar to those found on the 3rd.

In this case the quinine was given on the 30th, too late to affect sporulation, and the subsequent symptoms were undoubtedly due to toxæmia, resulting from the segmentation of a large number of parasites. This toxæmia probably continued throughout the development of the subsequent cycle.

*Case* 3.—Chart 3. Admission No. 103,790. Admitted August 2, 1911. R. R., Barbadian negro, age 24, three years in the Canal Zone. Three previous attacks of fever. Ill three days, fever, chills, and headache. Delirious during morning, and comatose on admission at 1 p.m.

Tongue, coated; eye, injected and jaundiced; liver, enlarged; spleen, slightly enlarged.

Blood examination: A very heavy æstivo-autumnal infection. Numerous young ring forms, and several pre-segmenting and segmenting parasites. Very many doubly infected erythrocytes, and many with three parasites, while sometimes four and five were seen in a red-blood cell.

At 2.30, 6, and 11 p.m., quinine, 20 gr. in 5 oz. of normal salt solution subcutaneously.

At 8 p.m. the patient was conscious and rational. However, this improvement should not be attributed to any action of the quinine, as it is not possible that the drug could affect either the adult parasites or the toxæmia. But it is very probable that the salt solution was of assistance in diluting the toxin and freeing the cerebral capillaries from the sporulating parasites.

August 3rd.—Blood examination. Very many unpigmented, fragmented parasites, many doubly infected erythrocytes, but very few with more than two parasites.

The patient was much better, and able to talk intelligently. At 11 a.m., and at 7.30 p.m., quinine, 23½ gr. in 8 oz. of normal salt solution. At 2.30 p.m., 10 gr. of a 1 in 4 solution of the bi-hydrochloride in 12 oz. of salt solution (1:500 about) were injected intravenously by Dr. T. W. Earhart, of this hospital. The reason for this injection was as follows: Although the patient was in good condition, the infection was quite as heavy as on the preceding day, and not a few of the parasites were becoming pigmented, showing that a strain very resistant to quinine was present. No ill-effects from the injection were observed.

August 4th.—Blood examination, 10 a.m. Many parasites were found. These were oval and round, and in the fresh specimen motionless, and a few showed central blocks of scanty pigment. In the stained slides the parasites were shrunken, with scanty chromatin and fragmented cytoplasm.

The patient became gradually semi-comatose about 6 a.m., and continued so until night, when a decided improvement was noted.

Quinine, 15 gr. in 5 oz. of normal salt, at 11 a.m. and 5 p.m., subcutaneously. It is obvious that quinine at this stage of the cycle could have had but little effect on the adult parasites, and only enough was given to kill the young plasmodia resulting from segmentation.

August 5th.—The patient was very much better. Only a few parasites, similar to those of the previous day, were found. Quinine, by mouth, in doses of 15 gr. three times a day, was ordered. The patient made a rapid and uneventful recovery.

*Remarks.*—It is probable that the coma on admission, which followed a delirium earlier in the day, was due to a partial blocking of the cerebral capillaries. Fortunately for the patient, in this instance the parasites sporulated before the capillaries were completely blocked. The delirium was undoubtedly due to toxin set free by the segmenting parasites in other parts of the body, as well as in the brain.

The semi-comatose state on the third day, unaccompanied by delirium and gradually increasing, was certainly due to a partial blocking of the cerebral capillaries by the adult parasites. There is but little doubt in my mind that the large doses of quinine, which were initiated when the cycle was very young, saved the patient's life; in fact, the prognosis was very grave until the fourth day in the hospital, notwithstanding the marked improvement on the second. It is not unusual to observe a marked improvement after the first coma of a pernicious attack has passed, and this improvement is not infrequently believed to be due to the quinine administered. In consequence of this fallacy, sometimes vigorous treatment is suspended, with a fatal result.

*Case* 4.—Chart 4. Admission No. 103,365. Admitted July 31, 1911. E.S.; Spaniard; aged 30; three years in the Canal Zone. Six previous hospital admissions, all for fever.

Ill three days, fever, chills, nausea, pain in chest and abdomen. No quinine.

Tongue, coated; eye, injected and jaundiced; liver, enlarged; spleen, not palpable.

Blood examination. Heavy infection with young æstivo-autumnal parasite. Scanty pre-segmenting and segmenting forms. Many doubly infected erythrocytes, and but few with three parasites.

The patient's physical condition was excellent; but in view of the quantity of the infection, quinine, 30 gr. in 10 oz. of normal salt solution, was given subcutaneously, in order to attack promptly the young parasites.

August 1.—Blood examination. The number of the parasites was decidedly lessened, and their vitality was markedly impaired, as shown by degenerative changes similar to those already described. Hardly a single parasite was unaltered.

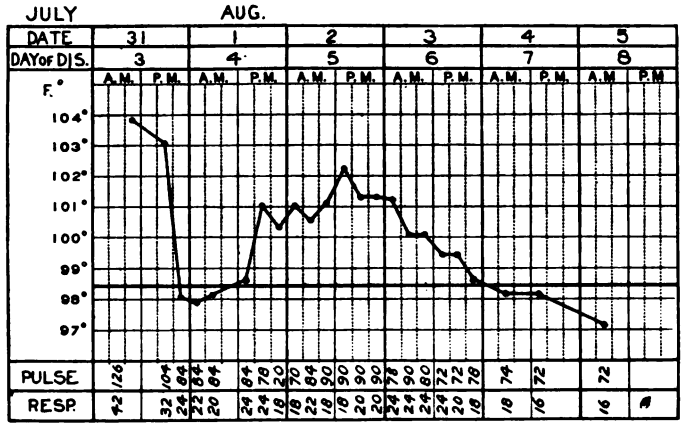


CHART 4.—E. S.

The condition of the patient was so satisfactory that it was decided to try the effect of quinine by the mouth, as the parasites were, in my opinion, so altered as to be considered not dangerous. 15 gr., three times a day was ordered. The patient passed through the subsequent paroxysm with little discomfort other than a slight headache, and recovered rapidly.

Of the remaining cases, one showed a very heavy infection with young forms and segmenting and pre-segmenting parasites. One dose of 30 gr. of quinine in 10 oz. of salt solution was exhibited, followed by the oral administration of 15 gr. three times a day. I should state that in all instances when quinine was given by the mouth an acid solution of the sulphate, 5 gr. to the drachm, was used. The course of the infection in this case was exactly similar to that in Case 4.

In five cases very heavy æstivo-autumnal infections were present, but segmenting forms were not seen. At least 2 to 5 per cent. of the erythrocytes were infected. One preventive dose of 30 gr. of quinine in 10 oz. salt solution, was given on admission, followed by 15 gr. three times a day by mouth. In each case the subsequent paroxysm was mild. A comparison with control cases in which the infection appeared to be equally intense, and in which quinine was administered by mouth in one dose of 20 gr. on admission, followed by 15 gr. three times a day, shows a shorter duration of subsequent fever and much milder clinical symptoms when 30 gr. was administered subcutaneously on admission.

There were two cases of tertian infection, which showed cerebral symptoms, and ended fatally. These cases belong to Class 4, *i.e.*, the type in which death occurs when the quantity of the infection does not appear sufficient to have brought about the fatal result. In each of these cases the patient was admitted delirious, and became comatose; and in each there was a moderate tertian infection. No abatement of the symptoms followed the use of quinine, although the drug was exhibited intravenously in one case on the second day, and subcutaneously in the usual dose in each of the cases the rest of the time. Each patient died on the third day after admission. At each autopsy a few tertian parasites were found; and neither intercurrent disease nor organic trouble other than mild nephritis was demonstrated.

It is not possible to say that any of the patients treated by the method advocated in this report would have died had quinine been administered in the usual manner and the usual doses. Recovery might have followed, even in Case 3, as in my experience it has followed in cases with similar infections. Also, the number of cases is too small to draw definite conclusions from, or to compare with cases treated as formerly. All I feel permitted to state at present is that the method of giving quinine early in severe infections, subcutaneously in large doses, or by intravenous injections, in dilutions of 1—150, or greater in intravenous injections, is logical and practical.

It is logical, because in these infections very large doses of quinine are needed to inhibit successfully the growth of the parasites, and the dilution insures prompt absorption. The infusion is rapidly taken up, most of it in two hours; and though sometimes painful, it is no more so than are hypodermic injections, and so far has not been followed by any permanent induration. In algid cases it would be better to give quinine intravenously.

It is practical, for it amounts to no more than the hypodermoclysis that is so often a part of surgical routine. A little cocaine in ¼ of 1 per cent. solution, injected in the skin at the proposed site of the hypodermoclysis will effectually prevent any subsequent pain.

Further, the method is a correct therapeutical measure, for normal salt solution so administered is beneficial in any toxic condition.

In a later communication I hope to present a large number of cases of severe infection treated by this method, and to compare the results so ob-

tained with those in cases treated as formerly. Also, I intend to analyze the causes of death in all cases of malaria in the past two years, and for another year, using for data the clinical records and autopsy preparations. I hope to be able to count accurately, after the method of D. Thomson and Sir Ronald Ross, of the Liverpool School of Tropical Medicine, the exact ratio between the number of infected erythrocytes per cubic millimetre and the degree of the pernicious symptoms in the negroes here, who are relatively immune against malaria, and in the Americans and in the European labourers, who possess a high degree of susceptibility to the toxins of malaria.

I wish to acknowledge my obligation to Captain A. C. MacGilchrist, M.A., M.D., I.M.S., for the use I have made of the very valuable and important data that he has so ably collected; and to thank Dr. W. E. Deeks, Dr. H. C. Carter, and Dr. F. F. Munroe, of the staff of Ancon Hospital, for their help and encouragement in the collection of the data embodied in this report.

*How Plague is dealt with in Hong Kong.**—The incidence of plague during 1910 was very light, only 25 cases being recorded, of which four were imported. The measures upon which the colony relies for the prevention of plague consist in (1) the exclusion of rats from all dwellings by means of concreted ground surfaces, the prohibition of ceilings in the native quarters, the prohibition of hollow walls, and the protection of all drain openings and ventilating openings by iron gratings. (2) The collection and bacteriological examination of all dead rats; facilities for their collection in the native quarters are provided in the shape of small covered tins attached to lamp-posts, telephone-posts, electric light standards, &c. These tins contain a carbolic acid disinfectant, and the inhabitants are invited to at once put into them all rats found or killed by them. There are 650 of these tins distributed throughout the city and its suburbs, and each of them is visited twice daily by rat-collectors, who take all rats found in them to the Government bacteriologist. Each rat is at once labelled with the number of the tin from which it is taken, and if subsequently found to be plague-infected, a special survey is at once made of the blocks of houses in the immediate vicinity of such tin, all rat-holes and rat-runs are filled up with broken glass and cement, defective drains and gratings dealt with, and rat poison freely distributed to the occupants, while the occurrence of several plague-infected rats in one locality is a signal for a special house-to-house survey and cleansing of that district. The disinfectant in the rat tins is renewed not less than once a week. (3) The destruction of rats by poison, traps and birdlime boards, special efforts in this direction being made just before the onset of the regular plague season, which in this colony is March to July. (4) The encouraging of the community to keep cats. (5) The systematic cleansing and washing out of all native dwellings at least once in three months with a flea-killing preparation. For this purpose an emulsion of kerosene is used. It is prepared by boiling in a steam-jacketed container 41 gallons of kerosene with 9 gallons of water and 15 lb. of soft soap; this mixture is highly inflammable, and it is essential therefore that the boiling should be done by steam and not by the direct flame; the emulsion mixes readily with water, and one gallon is added to every 100 gallons of water used for cleansing the houses and washing the floors, skirtings, bed-boards, staircases, furniture, &c. (6) An efficient daily scavenging of all streets and lanes, and the removal of refuse daily from all houses, coupled with the provision of covered metal dust-bins for all houses, to reduce as far as possible the amount of food available for rats. (7) The disinfection of plague-infected premises by stripping them and washing them out thoroughly with the kerosene emulsion, coupled with the disinfection of all bedding, clothing, carpets, rugs, &c., by superheated steam. No objection is raised to the treatment of bubonic plague cases in native hospitals, and no restrictions are imposed in regard to the burial of those dead of plague, except the provision of a substantial coffin, while every effort is made by means of lectures, addresses and explanations to induce the native population to participate in the above preventive measures.

All the cases of plague, twenty-five in number, occurred among Chinese, and twenty-three of them died, so that the case mortality was 92 per cent.

During the year 56,001 rats were caught or found dead in the City of Victoria, and 21,754 in Kowloon, a total of 77,755 as against 76,135 in 1909. Those from the city were examined by the Government Bacteriologist, Dr. Macfarlane, at the public mortuary, and those in Kowloon by Dr. Pearse, the Assistant Medical Officer of Health, with the result that 107 of those from the city and thirteen of those from Kowloon were found to be infected with plague. It was somewhat remarkable that throughout the whole of the year 1909 there was a marked preponderance of female over male rats caught, the numbers for the city being 28,946 males and 31,167 females, whereas during 1910 the numbers were practically equal, there having been 27,869 males and 27,802 females.

* Medical and Sanitary Reports, Hong Kong, 1910.

**"Medical Record," New York, September 30, 1911.**

*Chylangiomata.*—Farnsworth and Lindsay report a case of chylangiomata in the above number of the *Medical Record*. The case occurred in a boy of 7, and it baffled all diagnosis till an exploratory incision was made. Then four large cysts containing a large amount of chyle, formed by an enormous dilatation of lacteals in the mesentery of the bowel, were found. Unfortunately no autopsy was obtained at the subsequent death of the child. Such cases are extremely rare.

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THE JOURNAL OF

# Tropical Medicine and Hygiene

NOVEMBER 1, 1911.


## THE EFFECT OF CHANGE IN DIET, MEDICINES AND ENVIRONMENT ON INVALIDS SUFFERING FROM INTESTINAL FLUX.

"FROM the moment I was carried on board ship, I began to improve," is a commonly told tale of invalids arriving in Britain from the Tropics. "I was very well until"—and then something occurred to check the improvement. Sometimes the setback is due to recurrence of fever, to a return of diarrhœa, to an increased expectoration, and so forth. The improvement in cases of malaria when they get on board ship is most marked, and the explanation is not perhaps difficult to understand; but even many persons suffering from intestinal flux of various kinds find they are better, for a time only it may be, when they get on board ship. The cause of the improvement, real or fancied, is no doubt attributable to the change itself, to the fact that the place where the illness was contracted is left behind, and to the prospect of a holiday and return "home." For malaria cases the absolute rest, the absence of much difference between the night and day temperature at sea, and the impossibility of re-infection all tend to benefit the patient in addition to systematic taking of quinine. In cases of intestinal trouble the improvement is more difficult to explain. It may be that the change of diet, be it the milk, the meat, or whatever diet the patient is upon, has an effect. There is no doubt that change in diet causes a change of flora in the intestine. The organisms which thrive when milk is given are seldom able to continue their existence when meat supplants milk in the dietary and *vice versa*. After a week or so the diarrhœa usually returns, and the patient has relapsed to a perhaps worse state than previously. The change into a colder climate is usually held responsible for the setback—quite possible of course, but more often it is due to the same food being continued day after day, allowing a particular member (or several members) of the intestinal flora which at first was almost annihilated by the change to get accustomed to the new surroundings and to thrive and multiply in an altered medium.

The change in the stools when milk replaces meat, and *vice versa*, is most marked, and the change induced when the acid fermentation present in sprue is altered by an alkaline treatment are familiar examples of the effects of altered diet and medicine in intestinal flux. On board a "liner," everything in the way of food is, as a rule, different to that obtained on shore in a tropical country. The food may have been taken aboard at a home port, the water obtained at a distant source or condensed on board ship, the brand of milk, the vegetables, the aerated waters, &c., &c., may be, and usually are, all foreign to the traveller's place of residence, providing thereby a change at all points which has its results in so altering the intestinal flora, and the physiological and pathological results of the activities they induce, that temporary, and, in some instances, permanent benefit is effected. The lessons to be learned from the effect of change from shore to ship life upon persons suffering from an intestinal derangement are: (1) That sameness of diet is inadvisable; (2) that the continuance of milk or meat treatment for many weeks or months is wrong in principle and in practice; (3) that the administration of an acid or alkaline medicine for lengthy periods is deleterious; (4) that the benefits of alteration in diet and medicine are more important even than change of air; (5) that the change of climate being invariably attended by alteration in the nature and character of the food explains the benefit attributed to climate and place; (6) that monotony of diet means intestinal persistence of organisms, which, if they are of a pathological nature, continue to multiply and produce their toxins; (7) that change in diet means alteration of the intestinal flora; (8) that in ailments with acid fermentation of the stools, as in sprue, administration of alkalies alters the reaction of the intestinal contents, and thereby thwarts the growth of organisms capable of living in an acid medium and *vice versa;* (9) that after a change, continuance of acid or alkaline medicines, or of food that brought about improvement by the change, causes deleterious consequences, either because the originally affected organisms have become accustomed to the change or from the development of fresh organisms in the altered medium.

J. C.

# Abstract.

## RECENT ADVANCES IN OUR KNOWLEDGE OF SLEEPING SICKNESS.*

By Arthur G. Bagshawe, M.B., D.P.H.(Cantab.).

Dr. Bagshawe, after some introductory remarks, passed on to the question of the transmission of trypanosomes.

### Transmission by Glossina palpalis.

He said that it had been known since 1909 that after the ingestion by *Glossina palpalis* of blood containing *Trypanosoma gambiense* the fly is harmless for eighteen days or more, after which it may enter on a phase of "late infectivity" and be capable, for a period of unknown duration, of infecting susceptible animals. It was assumed that the latent interval in the fly was occupied by some developmental process. The Sleeping Sickness Commission in Uganda studied the development of the trypanosome in the fly with the object of finding out if its late infectivity coincided with any phase of the development. The interesting result was reached that an invariable accompaniment of late infectivity is the presence in the fly's salivary glands of the "blood type" of the trypanosome.

The same Commission experimented to see whether the trypanosome was infective *during* its development in the fly.

It was found that flagellates injected two days and less after the infective feed produced infection; between the third and twenty-fourth day, though in many instances the gut swarmed with parasites, there were twenty-eight negative and no positive experiments; and infections were again produced on the twenty-fourth, twenty-eighth, thirtieth, thirty-sixth and forty-sixth days. These results corresponded with those obtained when the flies were made to bite a series of susceptible animals; they showed that the trypanosome was not infective during its development.

### Transmission by Glossina morsitans.

Till recently there has been no laboratory evidence that *T. gambiense* can be transmitted by *G. morsitans*. One experiment done on the Victoria Nyanza had a negative result. Lately Taute repeated this experiment on Tanganyika. He fed 670 *G. morsitans* on an animal infected with a human trypanosome, and afterwards in sixteen groups on sixteen monkeys. Six monkeys became infected. The work of various observers, Bouet and Roubaud especially, seemed to show that in a laboratory experiment all the local species of tsetse can transmit any given local trypanosome, but that in Nature one species plays this part to the exclusion, complete or partial, of the rest. Laboratory evidence of the method of transmission in Rhodesia or Nyasaland, those extra-*palpalis* regions where *morsitans* is suspected of being the intermediary, was not yet to hand. Analogy and, in the case of Rhodesia, circumstantial evidence pointed to *morsitans*.

### Direct Transmission by Biting Flies.

Some experiments done by Schuberg and Kuhn in Germany were of interest, as showing the possibility of direct or mechanical transmission of trypanosomes when they were plentiful in the blood of the infected animal. The fly used was the widespread *Stomoxys calcitrans*. Of five attemps to transmit *T. gambiense* from mouse to rat by the agency of this insect two were successful; the few experiments in which there was an interval between feeds were negative. It was not said how frequent the parasites were in the blood of the animal donor, which is clearly of importance. If they were scarce, it was improbable that any would be retained about the mouth-parts of the insect; and the more numerous they were the more likely was infection to occur. There was no evidence that *Stomoxys* ever carried sleeping sickness; probably the trypanosomes were rarely sufficiently numerous in the blood.

### Other Methods.

Manteufel has shown that *T. lewisi* can penetrate the skin or mucous membrane of the rat and produce infection. Hindle made experiments to find out if the same held good for *T. gambiense*. He could always infect rats (number not stated) by introducing into their mouths by means of a syringe 1 c.c. of infected blood; feeding with infected organs in the five instances tried was not successful. Similarly, by dropping a little infected blood into the vagina of six female rats he produced infection in all. The most striking experiment, however, was one in which a drop of blood containing *T. gambiense* was spread on a rat the hair of which had not been shaved nor cut; the blood was allowed to dry, and covered with collodion (Manteufel's method). Of five rats so treated three became infected.

### Reservoir Hosts of Trypanosoma gambiense.

Bruce, Hamerton, and Bateman have shown that antelopes may act as a sleeping sickness reservoir. They sought the reason why, though the population had been removed for over two years, the tsetse flies on the north shore of the Victoria Nyanza continued to infect monkeys with sleeping sickness. Man in these areas had been replaced by large game; it seemed probable that these might be harbouring the parasites, and especially so because the Commission had already found that cattle may do so. By a very complete and convincing series of experiments they showed that antelopes could be readily infected with sleeping sickness by the bite of laboratory-fed *G. palpalis*, infected with a human strain; that these antelopes could transmit the infection to laboratory-bred *palpalis* which are fed upon them; that the *palpalis*

* A paper read before the Society of Tropical Medicine and Hygiene, October 20, 1911.

could in their turn infect susceptible animals by their bite; that the percentage of flies so infected might be, in successful experiments, over ten; and that the infection of the antelope did not disturb their health. They showed, moreover, that the trypanosomes might be exceedingly scarce in the infective antelope's blood.

### Diagnosis.

As regards diagnosis, Dr. Bagshawe said that Todd and Wolbach had lately made in the Gambia a comparative study of various methods of diagnosis. Their object was to find which method would discover the largest proportion of cases in the shortest time. They selected their cases by gland palpation and made fresh preparations of gland juice and blood, and thick as well as thin stained blood-films. Among 283 persons so selected they found trypanosomes in the gland juice five to six times more often than in the blood. More than fifteen minutes was rarely given to any method and a second examination was not made. They had little success with thick films and do not recommend them; trypanosomes were found more often in thin smears. Their treatment of thick smears, it should be noted, was not that of the German workers who advocate them. The diagnostic procedure which they recommend for routine examinations is—gland palpation and puncture, coverslip preparations of blood, centrifugalization of blood, thick blood-films, blood-smears, and animal inoculation.

The object of the expedition, Dr. Bagshawe thought, should be noted. The authors did not try to detect as many cases as possible. Had this been their purpose, they would doubtless have repeated their examinations, centrifuged the blood, made inoculations into susceptible animals, and performed lumbar puncture. They would have examined persons also with no glandular enlargement with a view to the detection of recent infections. They themselves, however, do not think that they missed many cases among those whom they examined. Records of all have been left in the country, and it is hoped that they will be kept under observation; unfortunately trypanosomes found in them after Todd and Wolbach's visit may be derived from an infection since contracted. The results support the general belief that gland palpation and puncture form a useful method of detecting cases of trypanosomiasis among native populations. Very recent infections, however, escape notice. Kinghorn, for example, in Ashanti, examined 119 men of the company stationed at Sunyani, first by gland palpation and puncture and afterwards by the blood method. By gland puncture two cases were found; by the blood method five others. None of the five presented any marked degree of gland enlargement and in one no glands were palpable.

The gland puncture method is of little value in Nyasaland, and gland palpation has been aban- by Dr. Meredith Sanderson. Sanderson relies on examination of the blood, and has diagnosed many cases from films made by his native assistants. Infected persons, he says, have cervical glands in no way different from those of a large majority of healthy natives. This is perhaps due to trypanosomiasis being new to this region, and therefore more acute. On the other hand, it is possible that this infection differs in symptoms, as in the morphology of its agent, from that hitherto studied.

A fresh diagnostic method, Dr. Bagshawe stated, had lately been practised by Levaditi and Mutermilch. It depended on the observation that, if the serum of an animal infected with trypanosomes is obtained after the first crisis—that is, when antibodies are present, inactivated and brought in contact with leucocytes and the corresponding trypanosomes—these stick to the leucocytes, usually by the aflagellar end. This phenomenon was first noted by Laveran and Mesnil in the peritoneal cavity of immune rats into which *T. lewisi* was introduced, and is called *attachment*. Levaditi and Mutermilch thought that by its means it would be possible to differentiate trypanosome species, but the attachment was found not to be strictly specific. Later it was suggested that human trypanosomiasis might be thus diagnosed, and attachment of more or less intensity was obtained with the serum of seven sleeping sickness patients in Paris. The trypanosomes (*gambiense*) were obtained from a rat, the leucocytes from a guinea-pig; these need not be fresh, nor even living, and the patient's serum may be kept for a longish period. Nagana serum was kept for ninety-five days without detriment to the reaction. Experiments in the field will soon determine the value of attachment as a diagnostic agent.

A still more recent method, which has not yet, however, been applied to sleeping sickness in man, is the macroscopic *agglutination* test described by Lange. Trypanosomes separated from the blood by centrifugalization are made into an emulsion, which is brought in contact with the serum of the animal known or supposed to be infected with that trypanosome. If the animal is uninfected, agglutination takes place at low dilution only or not at all; if it is infected, the trypanosomes agglutinate at very high dilutions. This test has answered admirably in a very large number of animal experiments with *T. equiperdum*, *brucei*, and *gambiense*, chiefly the first named. It works, moreover, a few days after inoculation, before trypanosomes are found by the ordinary methods. Lange's results have been vouched for by Uhlenhuth and confirmed by Winkler.

### Symptoms.

Dr. Bagshawe said that there was little to record under this heading. In connection with the onset of cases of trypanosomiasis in Rhodesia and Nyasaland attention had been drawn to the occurrence of painful swellings, usually in the neck, and Dr. May had suggested that these were caused by

some creeping nocturnal insect which transmitted the trypanosome. These swellings had sometimes the appearance of boils. They were dusky and painful and varied in size and number. Suppuration was often expected, but had never been recorded. Among the fifty cases of trypanosomiasis in whites collected in No. 20 of the *Bulletin of the Sleeping Sickness Bureau* there were six instances of these swellings; the patients acquired infection in the Congo, the Cameroons, and Angola, so that the symptom was not peculiar to Nyasaland and Rhodesia; in some cases it was traceable to the bite of a tsetse or other invertebrate. The pathology of these swellings was obscure, but their concurrence with other symptoms in persons exposed to infection might lead one to suspect trypanosomiasis.

### Treatment.

Dr. Bagshawe said that there were no accounts of the use during the past twelve months of new or untried drugs.

#### *Arsenophenylglycin.*

The results of treatment by arsenophenylglycin seemed to vary with the strain of *T. gambiense*, just as much as with the stage reached by the disease. While in suitable cases it appeared in Togoland to be specific, it was useless in German East Africa, and of only moderate benefit in Uganda. After relapses, or when once the parasites had appeared in the spinal canal, it seemed in all areas to be of less value than arsanilate.

Ullrich used the drug on natives in German East Africa, but as he gave it in small doses, frequently repeated and to unsuitable cases, his results are negligible. The same could not be said, however, of those of Scherschmidt, whose treatment trials were conducted in the same country. He gave the drug in the proper way, though the doses were in some cases large, to twenty-seven untreated patients, most of whom are stated to have had no symptoms but gland swelling. Six died within four weeks apparently from the effects of the drug, and eleven relapsed (trypanosomes seen in the blood of seven). Only three were improved. In nearly half the cases there was relapse or the disease progressed. The only possible explanation seemed to be that the cases were in reality advanced, and that the patients were unsuitable subjects.

Arsenophenylglycin was used in the Uganda sleeping sickness camps in 100 cases, sixteen of which are classed as early. Of the latter six had died within eleven months and two were worse, the results in the more advanced cases being naturally inferior. Sixty of the hundred were dead within a year; but it must be remembered that the proportion of early cases in these camps was small. McConnell thought that children reacted more favourably than adults. Very few toxic effects were noted. Nothing was said about blood relapses. Dr. Hodges concluded that arsenophenylglycin showed no superiority over several other drugs unless in the treatment of early cases, and that in these further trials were necessary.

#### *Antimony.*

Quite the most interesting contribution during the last twelve months to the therapeutics of this disease was Kerandel's paper, in which he gave an account of his case and of his cure by tartar emetic. He took atoxyl for eleven months till the trypanosomes were constantly present in his blood and appeared to be fast, while he himself was getting steadily worse. He then commenced the intravenous injection of a solution of tartar emetic, seventeen 10-centigramme doses on successive days. His red cells promptly ceased to agglutinate, and before the course was over all symptoms as well as trypanosomes had disappeared. Though he had other similar courses, he believes them to have been unnecessary. In the two years succeeding he kept perfectly well. It seems almost certain that he owes his recovery to antimony.

A similar case had been recorded by Camac. This also was a European treated by atoxyl. He had had twenty-six febrile paroxysms always associated with the presence of *T. gambiense* in the blood. Antimonyl sodium tartrate was then injected intravenously, thirteen doses in the course of seven weeks. The patient had been well and without trypanosomes since—that is, for one and a half years. The dose was but a tenth of that which Kerandel took.

In both cases there were alarming symptoms after one or more of the later injections—rigor, pain in the back, and fever lasting some hours. In Camac's patient there was weakness and abdominal distress of twelve days' duration. These symptoms were considered by Kerandel to be of an anaphylactic nature.

Of the use of *salvarsan* in human trypanosomiasis very little had been published. If one might judge from trials on animals, it would prove to be less effective than arsenophenylglycin.

With regard to atoxyl there was little fresh to relate. Thiroux and D'Anfreville, who made careful observations on sixty patients treated in Senegal, concluded that atoxyl should form part of every course of treatment; but they had a case of what they deemed recovery after the administration of antimony and orpiment. They obtained their best results with aniline antimonyl tartrate and atoxyl, but here again the period of after-observation was short.

### Prophylaxis.

Dr. Bagshawe said that G. L. Cleve, a planter in German East Africa, had practised, apparently with considerable success, the bird-lime method of catching tsetse flies devised by Maldonado. He found that the juice of a certain Euphorbia yielded the best lime. He spread it on cloth attached to the belly of transport animals which were kept on the move, and had thus trapped many *G. morsitans*

and *fusca*. Experiments with bird-lime had been made in Nyasaland also by Dr. J. E. S. Old. Liming was probably of more use for the protection of the animals than for the eradication of tsetse; but it seemed a good way of reducing their numbers, and it was possible that small, circumscribed fly areas might thus be rendered fly-free.

There had been much activity in describing new species of *Glossina*, the number of which was now at least fifteen. Professor Newstead had re-classified the genus on characters supplied by the male genital armature, and his classification had been to a large extent adopted by Mr. Austen. Austen divided the genus into four groups, each containing three or four species. In his "Handbook of the Tsetse-flies" were given tables for the determination of the groups and species.

The Sleeping Sickness Commission, with Dr. R. van Someren, had investigated whether the blood of treated patients would infect *G. palpalis*. Bred flies were fed on thirty-five native patients at various stages of the disease and afterwards on healthy monkeys. Except in the case of one patient, in whom clinical signs were well marked, all the experiments were negative.

The main principles of prophylaxis remain unchanged. The continued infectivity of *G. palpalis* in an area from which the natives had been moved, an infectivity which was almost certainly due to wild host reservoirs, formed a strong argument for continuous efforts at deforestation in preference to deportation of natives. The former seems to be practised in the German Colonies to a much greater extent than in the British.

## Notes and News.

### A NEW SLEEPING SICKNESS COMMISSION.

THE Government have appointed a new Commission, who will proceed to Nyasaland to study some of the new problems that have arisen in connection with sleeping sickness in that area. The Commission will consist of Colonel Sir David Bruce, Captain Hamerton, R.A.M.C., Major Harvey, R.A.M.C., and Mr. Newstead, of the Liverpool School of Tropical Medicine. The points at issue briefly are these. Cases of sleeping sickness have, within the last two years or so, been cropping up in Nyasaland and North-Eastern Rhodesia, and, though searched for, no signs of *Glossina palpalis*, the usual host, have been met with. This means that if the parasite causing these cases is *T. gambiense*, then that some other fly—*G. morsitans*, *brevipalpis*, or *fusca*—is acting as a host. On the other hand, the parasite may be distinct, as Stephens believes, and if this is so, his *T. rhodesiense* may be normally carried by *G. morsitans*. The whole subject of human trypanosomiasis, which, a few years ago, seemed to be satisfactorily settled, will in the light of these new discoveries require revision, and this the Commission will no doubt undertake. Another Commission is at present engaged in North-Eastern Rhodesia on similar lines of research.

### DRUG ADULTERATION IN THE TROPICS.

DURING the past few months articles have appeared in several of the medical journals dealing with the adulteration of drugs imported into the Tropics, and if one is to judge by the results of analysis of several of these drugs which have been published, it is time this question was given serious consideration on the part of the Government. It has been stated that: "If adulterated drugs are used, the patient cannot be benefited to the degree expected, and the reputation of the doctor suffers." No one would question the accuracy of this statement. As quinine is the drug most frequently prescribed in the Tropics, it is essential that it should conform in every respect to the B.P. tests. By prescribing "Pulverette" Quinine, practitioners are assured that the quinine contained therein is of standard quality, and that their patients will obtain the maximum therapeutic effect of the drug. It is impossible for the Pulverette to pass through the system unacted upon. When we consider the serious defects of pills and compressed tablets, this method of medication should prove of great service in all cases where the use of quinine is indicated.

MESSRS. BURROUGHS WELLCOME AND CO. have been granted no fewer than thirteen awards at the Turin International Exhibition.

INDIAN papers declare that cocaine is being smuggled into India in large quantities. It is said to be introduced surreptitiously in books, cycle tyres, and in a multitude of other fashions, rendering its importation difficult of detection by the authorities. The source of the drug is said to be from various towns in Germany and Austria. The cocaine habit seems to be growing in India to an alarming extent.

THE recent outbreak of cholera at Delhi is ascribed, as usual, to water drawn from polluted wells. Delhi has a public water supply, and the source of the water is under control. It is said, however, that the temperature of water drawn from the taps and hydrants is so high in the hot weather compared with the water drawn from the wells, that the drinking water is taken from these wells, with disastrous consequences. The practical lesson to be learned from this observation is that pipes carrying the water supply to a town in tropical countries ought to be laid as deeply as possible in the ground in their passage from the reservoir to the houses, so that the water may be kept as cool as possible.

## LONDON SCHOOL OF TROPICAL MEDICINE.

THE annual dinner of the London School of Tropical Medicine was held on Tuesday, October 17, at Prince's Restaurant, Dr. Cameron Blair, Senior Sanitary Officer, Northern Nigeria, being in the chair. Among those present were Sir Patrick Manson, Dr. C. W. Daniels, Dr. F. M. Sandwith, Professor W. J. Simpson, and others connected officially with the school. Among the guests were Sir James Porter, K.C.B., Director-General of the Royal Navy Medical Service; Surgeon-General A. M. Branfoot, C.I.E., President of the Medical Board, India Office; and General Sir Reginald Talbot. The dinner, admirably organized by Mr. P. Michelli, C.M.G., secretary of the school, was well calculated, in accordance with the precept of Quintilian, to conciliate the audience in favour of the orators of the evening. The speeches all had the supreme merit of brevity, though some of the speakers displayed a tendency to a tropical luxuriance of fun and anecdote not inappropriate to the occasion. After the customary loyal toasts, the "London School of Tropical Medicine," was proposed by Surgeon-General Branfoot, who, after a short account of the origin of the school, spoke strongly of its value to medical officers of the Indian Service. He said he always asked those who had been through a course at the school what they thought of it, and the reply was uniformly most favourabble. Sir Patrick Manson, in responding, spoke of the steady extension of the school, which placed a heavy strain on the funds. He made a strong appeal for further financial support, He said that the accommodation for students who found it convenient to live in close proximity to the scene of their work had been encroached upon by the provision of new laboratories, and there was a difference of opinion whether expansion should now take the direction of again increasing the residential accommodation. It was suggested that this question should be submitted to a referendum. This was done in the course of the dinner, and those who signed the paper were unanimously in favour of the proposal to provide more rooms for students. Sir Patrick Manson announced that it had been decided to produce a journal devoted to the work of the school. At present it would appear once a session, but it was hoped that in time it would be published more frequently. The toast of "The Guests" was proposed by Captain A. W. Clarke in a racy speech. Sir James Porter, in responding, referred to the proposed establishment of a Naval Medical College at Greenwich. The Admiralty, he said, was ready to carry out the scheme in an ungrudging spirit, but the wheels of Government moved slowly, and there were difficulties in the way. Accommodation for thirty newly entered officers would, however, be ready on December 31, and after that he hoped they would be able to build further. It was intended that every year fifty officers should pass through the school; men of five or six years' service would go through a course of six months, and seniors of fourteen years' service would go through one of three months. Those newly admitted to the service would study for two months at Greenwich, and then pass on to Haslar, where their practical acquaintance with the conditions of medical service afloat must necessarily be acquired. At present the Admiralty could only provide professors of pathology and hygiene; for the rest they would have to depend on the Dreadnought and the School of Tropical Medicine. Details of the arrangements were now being discussed, and in due course a report would be submitted to the Consultative Board, on which the medical profession was represented by Sir Watson Cheyne, Sir Dyce Duckworth, and Professor Simpson. Sir James Porter said he saw in the establishment of this college a means of greatly increasing the prestige of the Naval Medical Service. The health of the Chairman was proposed by Mr. Cantlie in his usual breezy manner. Alluding to the fact that Dr. Cameron Blair had arrived in Nigeria shortly after a devastating epidemic of malaria, he burst into poetry with the following adaptation of the famous Highland song:—

Had I been there with "Jeyes" at hand,
Quinine as my stand-by,
That day along the Niger's banks
I'd scotched the wary fly.
Not all the force of toxic germs,
Anopheles and gnats.
Not all the hosts of tsetse-flies
Nor hordes of plague-struck rats,
Not all the Sultans in the land
Had borne me backward then;
For I wage war on all the ills
That prey on Niger men.

With a graceful acknowledgment from the Chairman the proceedings came to an end. As a proof of the success of the school we may point to the fact, alluded to by more than one speaker, that since its foundation in 1899 some 1,200 students have passed through it. During the past year the number was over 130. For the present session 47 students have entered for the complete course and 7 for special courses in hæmatology, entomology, and protozoology.—*British Medical Journal.*

## Annotations.

*The Morbid Anatomy of Yellow Fever.*—Seidelin, writing in the *Yellow Fever Bureau Bulletin* for September, 1911 (Vol. No. 5), on the *post-mortem* diagnosis of yellow fever, states that the one constant and prominent feature at the autopsy is the fatty metamorphosis which is found more or less developed in the liver.

In some cases, he says, this alteration completely dominates the picture. In every hepatic cell several fat drops of different size are seen, some of which are very large; they may completely obscure the view of the nucleus and other cell-structures. In some cases one gets the impression that the same total amount of fat may be present as in a fully-developed case of so-called fatty infiltration of the liver, but the distribution

is different. Whilst in the fatty infiltration the fat is contained principally in the cells occupying the peripheral parts of the lobules, we have in the yellow-fever liver practically all cells affected to almost the same degree. Moreover, one does not find here the enormous fat drops which are seen in typical infiltration, where a single drop often occupies a whole cell and distends it considerably. The cells of a yellow-fever liver may also be distended, but then they contain several fat-drops each, with intervening protoplasmic elements. The aspect is similar to that obtaining in phosphorus-poisoning, and closely corresponds to the classical descriptions of fatty degeneration, only representing an extreme degree. Modern investigations tend to show that in all cases of fatty metamorphosis the fat is introduced into the cell from without, *i.e.*, by infiltration, and that, consequently, fatty degeneration in the old sense of the word does in reality not exist. The fact remains, however, that there are different histological characters which seem to indicate the existence of two kinds of metamorphosis, as described by earlier writers, no matter what the differences between them may be. The yellow fever liver corresponds well to the characters of a degenerative metamorphosis, also in the sense that the affection evidently represents a much more serious interference with the function of the cell than that produced in a case of typical fatty infiltration. A complete destruction of the cell does not take place, since the nucleus, as a rule, stains fairly well, as can be seen in specimens of the same livers in which the fat has not been stained.

In many cases the fatty metamorphosis is practically the only alteration of any importance; in such cases there may be, as an additional phenomenon, a slight microcellular infiltration around the vessels in the portal spaces. But, more frequently still, there are other important phenomena besides the fatty metamorphosis. Such phenomena are: Necrobiosis, hyperæmia, and cellular infiltration. Necrotic alterations may be observed in cells in which there is also advanced fatty metamorphosis, or both phenomena together may have attained such a degree that only masses of detritus are left, representing groups of cells, and alternating with groups of fat-containing cells. The hyperæmia macroscopically shows an irregular distribution, but is rather diffuse in its histological relations. There is especially no definite localization inside the hepatic lobule. If anything, it appears more pronounced in the central portions of the lobules, around the hepatic vein, than in the neighbourhood of the portal veins. In fact, it may be difficult to recognize the central vein amongst the numerous other spaces filled with blood. The cellular infiltration corresponds chiefly to the portal spaces, but may be continued into the interior of the lobules. It may be very abundant, and always consists essentially of lymphocytoid cells; polymorphonuclear leucocytes are observed in very small numbers only.

The microscopic examination of the liver may be of considerable help in establishing the diagnosis of yellow fever, if the macroscopical *post-mortem* appearances do not seem sufficiently characteristic. In this case stress should be laid upon the demonstration of the fatty metamorphosis as the most characteristic phenomenon.

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*Health in the Philippine Islands.*—In the Quarterly Report of the Bureau of Health for the Philippine Islands for the second quarter of 1911, Dr. Fox, the Acting Director of Health, states that during the quarter not a single case of cholera was reported. There were a few deaths under circumstances which were rather suspicious, but in all cases such deaths were closely investigated and when necessary an inspector was sent to the town in which the death occurred to watch for further developments. In most instances the president of the municipal board of health was furnished with tubes containing agar, which he smeared with stools from the cases, and these were sent to the Bureau of Science for examination. So far all have been negative bacteriologically. As a routine matter the same procedure was carried out in Manila in cases of death from acute enteritis or dysentery, and where a diagnosis of meningitis, infantile beri-beri, or other disease, had been made by the attending physician, if in the opinion of the medical inspector there was any question as to the real cause of death.

Cases of small-pox were few and far between in most places in the Islands. Some still continue to be reported from Cebu and Oriental Negroes. In Oriental Negroes it would seem that many people, especially those living at the foot of the mountains, were not, heretofore, thoroughly vaccinated, and an effort was now being made to perform vaccination among these people on a large scale.

As regards plague, the Philippine Islands were still surrounded by plague, and that this danger was more or less acute was shown from the fact that a case of bubonic plague developed in a Chinese immigrant, detained at the Mariveles quarantine station, who came from a plague-infected port. It was clear that if this quarantine had not been imposed this immigrant would have developed the condition after having been landed in Manila.

Notwithstanding the increased number of rats that had been trapped and examined in Manila no plague-infected rats have been found.

During the month of May a leper collecting trip was made, touching at the ports of San Fernando, Tagudin, Vigan, Aparri, Polillo, Atimonan, Cabusao, Legaspi, Catbalogan, Tacloban, Surigao, Cagayan, Hilongos, Cebu, and Iloilo. At Cebu there were more lepers than could be taken aboard with those already collected and it was necessary to make a second trip. A total of 270 lepers was collected and taken to Culion.

# Notices.

## THE SOCIETY OF TROPICAL MEDICINE AND HYGIENE.

At a meeting of the Society of Tropical Medicine and Hygiene, held at 11, Chandos Street, Cavendish Square, London, W., on Friday, October 20, 1911, the following candidates were elected Fellows of the Society: C. H. L. Bellot, M.D., Dominica; Ashton Bond, M.D., Toro; Herbert P. Cole, M.D., Mobile, U.S.A.; W. E. Deeks, M.D., Ancon, Panama; Eric J. de Verteuil, M.B., Trinidad; Ferdinand A. de Verteuil, M.R.C.S., Trinidad; John R. Dickson, M.B., Trinidad; James W. Eakin, M.D., Trinidad; Albert W. Easmon, M.B., Sierra Leone; Hugh George Hobson, M.R.C.S., Hong Kong; W. M. James, M.D., Ancon, Panama; R. D. Keith, M.D., Singapore; Fleet-Surgeon L. Kilroy, R.N., Plymouth; S. G. Kirby-Gomes, F.R.C.S.(Ed.), London; Ed. W. Kirk, M.B., Canton; André P. Lange, M.R.C.S., Trinidad; Vernon L. Matthews, Surgeon, R.N.; Lieutenant-Colonel T. R. Mulroney, I.M.S., M.D.; Albert A. Myers, M.R.C.S., Dominica; Sir James Porter, K.C.B., The Admiralty; Edward I. Read, L.R.C.P. & S., Trinidad; Captain A. J. H. Russell, I.M.S.; N. F. Surveyor, M.D., M.R.C.P., Bombay; Sydney Senhouse, M.B., Dominica; R. A. L. van Someren, M.D., Uganda; William C. Wigan, M.R.C.S., Likoma; Edwin Jos. Wyler, M.D., London.

# Correspondence.

*To the Editors of the* Journal of Tropical Medicine and Hygiene.

Dear Sirs,—I have just been reading in your issue of October 2, 1911, the article entitled, "Five to Seven in the Tropics—the Pre-dinner Period and its Dangers."

Will you allow me to say that we have never needed to use champagne or whisky on our Mission Station on the Upper Congo? As the temperature generally begins to fall after 3.0 p.m., the hours from five to seven are hardly the ones when one feels most thirsty. We usually have afternoon tea or a lime drink about 2.0 or 3.0 p.m., the heat being greatest from noon till 3.0 p.m.

I think limes will generally grow in the Tropics, and a *little* lime juice added to a glass of water, with or without sugar, is very refreshing at any time when one is thirsty.

But for many years past we have kept essence of ginger or tincture of ginger at hand, and if very fatigued we put a few drops of it into a cup of tea. This is a "Medical Comfort" that finds a place in the lunch basket when we go itinerating, and we have often found it, after a tiring march, the best thing to give us an appetite for a meal.

Personally, I find gardening about the best exercise on the station, and often get an hour at it before 10 a.m., or after 5 p.m.

We close our wire gauze doors and windows at sunset, about 6 p.m. all the year round, and try to keep inside them as much as possible for the rest of the evening, as we are seldom quite free from mosquitoes.

I am, dear Sirs,

Yours truly,

*London,*
*October* 13, 1911.

(Mrs.) E. Billington.

# Recent and Current Literature.

*A list of recent publications and articles bearing on tropical diseases is given below. To readers interested in any branch of tropical literature mentioned in these lists the Editors of the* Journal of Tropical Medicine and Hygiene *will be pleased, when possible, to send, on application, the medical journals in which the articles appear.*

### "Quarterly Journal of Microscopical Science."

*The Spirochætes.*—In the *Quarterly Journal of Microscopical Science* for April, 1911, Dobell writes that he believes that the organisms recently included under the term *Spirochætes* may properly be embraced in a single group for which he proposes the name *Spirochætoidea.* Under this head he would include three genera as follows:—

(1) Spirochæta = free living, aquatic spirochæts.

(2) Treponema = Spirochætes parasitic in various animals, *e.g.*, the organism of syphilis, the organism of relapsing fever, &c.

(3) Christispira, parasites living in the intestines, and cystalline style of Lamellibranchs. Thus constituted, Dobell holds that the *Spirochætoidea* should stand as a separate group of Protista—distinct from the protozoa, the bacteria, and the byanophyceæ.

### "Sleeping Sickness Bureau Bulletin," No. 30, 1911, vol. iii.

The *Rhodesian trypanosome.*—Bagshawe states that F. Mesnil and J. Ringenbach have studied at the Pasteur Institute the Rhodesian trypanosome to which Stephens and Fantham gave the name *rhodesiense.* They draw attention to its polymorphic nature. As regards its internal morphology they do not notice any essential difference between it and *Trypanosoma gambiense*, but they think that the existence of a certain number of individuals with nucleus situated very far back seems really to constitute a difference between the two trypanosomes—they also note the extreme virulence of the Rhodesian strain. Some serum experiments indicate that the two trypanosomes are closely related, however.

### "The Journal of the American Medical Association," September 30, 1911.

*Undulant Fever.*—Gentry and Ferenbaugh report on the presence of undulant fever (Malta fever) in Texas. They state that they have established the fact that the disease exists endemically in the goat-raising sections of Texas. Further, they show that the infecting organism, the *M. melitensis*, is present in the goats, this conclusion being based on their observations that:—

(1) About 20 per cent. of all goats examined (151) have given a positive agglutination test at 1 in 20 dilution, three going also to 1 in 40 in thirty minutes.

(2) All cases reported by them gave a history of association with the goat-raising industry, and six gave a history of drinking goat milk.

(3) A large number of these goats were direct descendants of goats imported from Asia Minor and South Africa, where the disease has been proved to exist in goats.

# Notices to Correspondents.

1.—Manuscripts sent in cannot be returned.

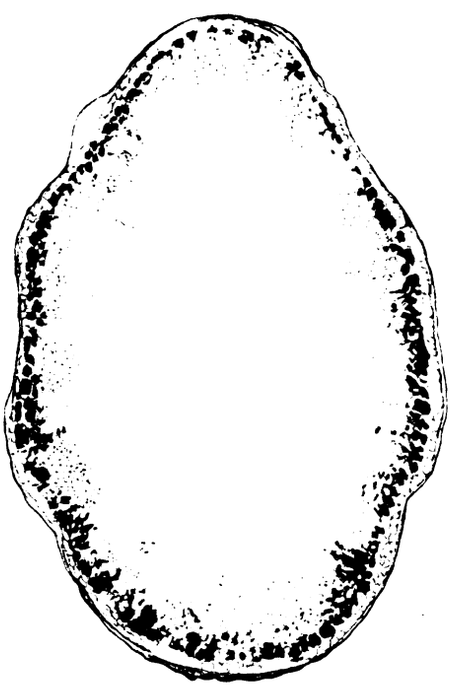
2.—As our contributors are for the most part resident abroad, proofs will not be submitted to those dwelling outside the United Kingdom, unless specially desired and arranged for.

3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.

4.—Authors desiring reprints of their communications to the Journal of Tropical Medicine and Hygiene should communicate with the Publishers.

5.—Correspondents should look for replies under the heading "Answers to Correspondents."

PLATE I



A. J. E. Terry, del. Bale & Danielsson, Ltd. imp.

TRANSVERSE SECTION OF PADI (HUSK REMOVED).

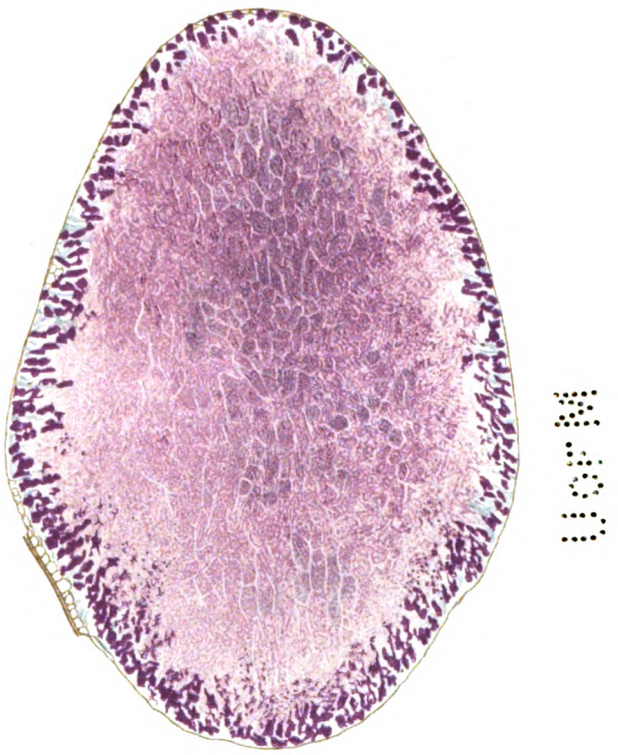
PLATE II

A. J. E. Terzi del

Bale & Danielsson, Ltd lith

TRANSVERSE SECTION WHITE (POLISHED) RICE

PLATE III



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TRANSVERSE SECTION PARBOILED (UNPOLISHED) RICE

## Original Communication.

# THE ETIOLOGY OF BERI-BERI.*

By HENRY FRASER, M.D.(Aberd.),
*Director, Institute for Medical Research, Federated Malay States,*
AND
A. T. STANTON, M.D.(Toronto),
*Bacteriologist, Institute for Medical Research, Federated Malay States.*

CONTENTS.

Introduction—Rice: histological and chemical—Feeding experiments on animals—The poison hypothesis—Experiments with various white rices—Starvation and forced feeding experiments—Experiments with unpolished rices—Experiments with rice meal or polishings—The phosphorus content of rices—The effect on protective substances of exposure to high temperatures—Experiments to determine the nature of the protective substances—Conclusions—References.

## INTRODUCTION.

THE etiology of beri-beri has been the subject of investigation by workers in many countries, and in view of the wide divergence of the conclusions arrived at and the varying results of the preventive measures suggested, it will be apparent that the problem is one of great complexity. Not a little of this confusion has been introduced by the lack of agreement among authorities as to what disease conditions are to be included under the name beri-beri. A survey of the voluminous literature which concerns itself with this disease will show not only that forms of polyneuritis of different etiology have been called beri-beri, but that even diseases of which polyneuritis may not be a prominent feature such as "epidemic dropsy," "ship beri-beri," "Ceylon beri-beri," and the like have been included under this name. It is not to be expected, therefore, that any single etiological factor will satisfactorily explain all the recorded oubreaks of so-called beri-beri.

The Malay Peninsula has long been known as an "endemic focus" of beri-beri and the recorded sickness and mortality rates from that disease during the past several decades show that great economic losses have resulted from its ravages. The Government of the Federated Malay States have in consequence greatly interested themselves in furthering investigation into the cause of beri-beri, and five years ago the task was assigned to us of attempting to define more narrowly the etiological factors concerned. In previous papers the results of this work as obtained from time to time have been set forth and it is now proposed to review the progress made and to submit the details of the work upon which our conclusions are based.

* Studies from the Institute for Medical Research, Federated Malay States. No. 12. Singapore: Kelly and Walsh, Ltd., Printers, and at Shanghai, Hong Kong, and Yokohama. 1911.

At the time this inquiry was begun, students of the disease were divided into two principal groups in regard to their views of its origin. On the one hand it was held that beri-beri had its origin in some organism, bacterial or protozoal, and that the disease was communicable, directly or indirectly, from man to man (Manson, Scheube, Daniels, Wright); on the other hand it was maintained, more particularly by physicians in Eastern Asia where the disease is most common, that the cause of beri-beri was to be sought for in food.

An examination of the evidence put forward by these latter workers, notably Takaki in Japan, Eijkman, Grijns, Vorderman and others in the Dutch East Indies and Braddon in this country make it difficult not to believe that the question of diet was a factor of great importance in the causation of beri-beri and that inquiry along this line held out the best prospect of success.

Attention was directed long ago to the influence of diet in the causation of beri-beri. Wernich [1] who studied the disease in Japan, writing in 1878, says: "The kak-ké is a chronic constitutional disorder of blood-making and of the vascular system. Rice as the exclusive food of the people is answerable for it in a quite especial way. Not, however, as some have thought because it is used in a decomposed state, but because it is used in such quantities that the power of assimilation is gradually lost for other kinds of food; and even the large quantity of rice is unable to render the nutrition and blood-making adequate."

Van Leent [2] from his experiences in the Dutch East Indies, wrote: "The dietetic error which I regard as the one and only cause of the morbid composition of the blood in beri-beri consists in the too small proportion of albuminous substances and fat." In support of this he gives the experiences of the disease in the Dutch East Indian fleet from 1870 to 1878, particularly during the war in Acheen both among the native and European members of the crews.

Takaki [3] believed the disease to be due essentially to nitrogen starvation, and in 1884 introduced certain reforms in the diet of the Japanese Navy. Up to this time beri-beri had been an important source of invaliding and mortality among the sailors, of whom about 30 per cent. were incapacitated annually from that disease. By the beginning of 1890 under the improved diet beri-beri was wholly eradicated and the incidence of other diseases greatly decreased. Takaki still adheres to this view of beri-beri causation, and in the course of a series of lectures on "The Health of the Japanese Navy and Army" in 1906 [4] he gives fresh evidence in its support: "Another illustration of the influence of diet upon the health of the men is shown by the fact that there was not one case of beri-beri among the sailors of the naval brigade before Port Arthur, although there was a large number of cases in the army. These men lived among the soldiers and under exactly the same conditions, but they differed from the soldiers

in one respect, that they were supplied with 1 lb. of meat, 10 oz. of barley, and 20 oz. of rice *per diem*, while the soldiers were supplied with 5 oz. of meat and 30 oz. of rice. The above example confirms my view that beri-beri largely occurs among men who are fed with an insufficient quantity of nitrogenous food and an excess of carbohydrates."

Durham [5] who studied the disease on Christmas Island and in the Malay Peninsula, while concluding that: "so far as there was any semblance of a positive result in the observations it is suggestive that beri-beri is communicated from person to person more or less directly through fomites as an actual infection," stated that: "It was difficult not to believe that the presence of some constituent of the diet had a sheltering effect on the nervous system of the individual," and again, that "it is suggested that certain articles of diet by virtue especially of containing phosphorized and fatty matters may tend to ward off the disease when given in sufficient amount."

Professor Chittenden, quoted by Bryce (*British Medical Journal*, December 11, 1909), says with regard to the statement that the Japanese Navy had found that a high protein diet was accompanied by a diminution in the number of cases of beri-beri, he contended that it did not necessarily follow that the increase of protein was the cause. He thought that it was much more likely that other elements were introduced into the food capable of accounting for the disappearance of the disease. Protein pure and simple is unlikely to be utilized as a food in the body. It is much more likely that it requires to become a salt of lime, potash or soda before it can be available for dietetic purposes. He thinks the mineral salts introduced with the protein prevented beri-beri much in the same way that lemon juice prevents the appearance of scurvy.

Epidemically and endemically the occurrence of beri-beri is certainly greatest in those tropical and sub-tropical countries whose inhabitants partake of a diet in which rice forms an important and generally the staple constituent. The other articles of diet vary with the country, but rice varies merely in kind or quality and but little in regard to the quantity consumed.

In those countries where the disease is endemic the incidence has always been greatest among the poorer classes, inmates of public institutions and the like. Supporters of dietary hypotheses have therefore sought to account for the occurrence of the disease in that the diet consumed was deficient in some substance or substances essential for nutrition, and those workers who have incriminated rice consider either that a diet in which this article bulks largely is deficient in protein or fat, or that the rice has become diseased from the action of moulds or other organisms.

The suggestion of a relationship between a rice diet and beri-beri is a very old one and there are numerous references to it in the literature of the disease. In the second edition of Hirsch's "Handbook of Geographical and Historical Pathology," published in 1881, a review is given of the various hypotheses propounded to explain the origin of beri-beri. Dr. Hirsch says: "The conjecture that the morbid poison is some *specifically noxious thing in the food*, brought about by the local conditions, is a probable one, and there has been no lack of hypothesis in that sense. At an early period the question was propounded whether it might not be *poisonous property of (decomposed) rice* that represented the cause of the malady."

This conjecture was revived by Braddon [6] who studied the disease in the Federated Malay States and the contributions made by this observer have led to material advances in our knowledge. Braddon was the first to show the closeness of the relationship which exists in this country between the consumption of white rice as a staple article of diet and the disease beri-beri. Of even greater importance was his demonstration of the fact that where the staple article of diet is rice which had been parboiled before husking as used by the Tamil population, or rice as prepared by the Kampong Malays, the disease does not occur.

As will presently appear this position which for many years Braddon defended in local medical circles has since been abundantly justified by controlled experiments.

Braddon's conception of the mechanism of beri-beri causation through white rice ("stale uncured rice") was that "the cause of the disorder is not indeed rice, *qua* rice, or as an article of diet, but diseased rice; rice from which some poison derived from decay, due perhaps to some fungus, or mould, or germ, or spore originally perhaps growing upon the husk, has become mixed during the process of milling; or upon which such fungus may have grown and such poison have been produced after milling."

In accordance with this hypothesis Braddon recommended as preventive measures the use of fresh rice (Malay rice or freshly milled rice), or rice that had been parboiled before husking. He conjectures that in the parboiling process the hypothetical organisms are made to germinate and in that vulnerable stage are destroyed by heating. He compares the process to that employed in laboratories to sterilize or render free of noxious germs various materials which may contain them.

This hypothesis of beri-beri causation has not met with acceptance by the later investigators, Grijns, Kiewit de Jonge, Schaumann, Aron and others, who regard the disease as the result of some defect in the composition of the foodstuffs ingested.

With a view to determine the position of white rice in regard to the causation of beri-beri, Dr. Fletcher [7] carried out a series of observations extending over two years among the patients in the Lunatic Asylum, Kuala Lumpur. In his report of the results Dr. Fletcher says: "During the year 1905 a large number of lunatics in the Kuala

Lumpur Lunatic Asylum suffered from beri-beri. Ninety-four of the 219 lunatics treated in the Asylum were affected, and twenty-seven died from the disease.

"With the purpose of testing Dr. Braddon's theory, observations were carried on in the following years (1906, 1907) with regard to the diet of the patients. Half of the patients were placed on a diet of 'cured' (parboiled) rice, while the other half remained on the diet of 'uncured' (white polished) rice, which kind all the lunatics of the Asylum had been eating previous to the commencement of the observations.

"The lunatics were housed in two exactly similar buildings on opposite sides of a quadrangle surrounded by a high wall. On December 5, 1905, all the lunatics at that time in the hospital were drawn up in the dining shed and numbered off from the left. The odd numbers were subsequently domiciled in the ward on the east side of the courtyard and no alteration was made in the diet; they were still supplied with the same uncured rice as in 1905. The even numbers were quartered in the ward on the west side of the quadrangle and received the same rations as the occupants of the other ward, with the exception that they were supplied with 'cured' rice instead of the 'uncured' variety. The two batches of patients were kept in separate wards and fed at different times. Separate cooking and feeding utensils were used, but otherwise the patients were allowed to associate together. At the half-year the two batches were changed over to each other's apartments."

The result for 1906 was that "out of 124 inmates fed on 'uncured' rice thirty-four suffered from beri-beri, two of whom were suffering from the disease on admission and eighteen died; whereas among 123 inmates fed on cured rice there were only two cases of beri-beri, both of whom were suffering from the disease on admission, and no deaths."

At the end of 1906 there remained thirty-five lunatics in the "cured" rice ward and thirty in the "uncured" rice ward. The first patient admitted in 1907 was admitted to "uncured" rice, the second to "cured," the third to "uncured," and so on to the end of the year.

During the year 1907, 136 patients were treated in the "uncured" rice ward. Of these patients twenty-eight suffered from beri-beri, four of whom were suffering from the disease on their admission. During the same year 131 patients received a diet containing "cured" rice; four of them were admitted actually suffering from beri-beri, but none of these 131 patients developed the disease in the Asylum.

Fletcher concludes that: "The cause of beri-beri is to be sought for in the diet. The result of the experiment tends to show that white polished rice, although of the best quality, is a cause of beri-beri, acting either by some poison which it contains or by a starvation due to some defect in the nutritive value of such rice."

In 1907-1908 the writers carried out a series of observations designed to test the position of white rice as a causative agent in the production of beri-beri. A detailed account [8] of this inquiry has already been published, and the results may here be summarized.

It was considered important that these observations should be made in a place hitherto free from the disease, and where the operation of factors other than diet could be excluded or adequately controlled. Satisfactory conditions were obtained at Durien Tipus in Negri Sembilan, where some 300 Javanese labourers were engaged in the construction of a new road through virgin jungle, remote from the complex conditions which interfere with observations in populous areas. The quarters occupied by these labourers were new and the sanitary conditions were satisfactory.

The 300 labourers were divided into two parties of approximately equal numbers and were housed some miles apart. Before beginning the experiment an examination was made of each person, and the presence of cases of existing or recent beri-beri was thereby excluded.

To one party white rice (No. 2 Siam) was issued as the staple article of diet, and to the other party parboiled rice. In about three months cases of beri-beri began to occur among the members of the party on white rice. When a certain number of cases had been noted white rice was discontinued, and thereafter no cases occurred. No sign of the disease appeared among the control party on parboiled rice.

The conditions were then reversed. The party hitherto on parboiled rice were given white rice, and after a somewhat longer interval than in the first instance, beri-beri broke out in this group also. This outbreak ceased on discontinuing the issue of white rice. Again no sign of the disease appeared among the control party on parboiled rice. By the transfer of individuals suffering from beri-beri and of whole groups in which the disease was occurring it was found possible to test the influence of place considered as a nidus of infection and also to test the possibility that the disease was communicable from one individual to another.

The average daily ration was as follows:—

| | | |
|---|---|---|
| Rice ... ... ... | 21.3 oz. | 603 grm. |
| Dried Salt Fish ... | 4.25 ,, | 120 ,, |
| Onions ... ... | 1.75 ,, | 50 ,, |
| Potatoes ... ... | 1.75 ,, | 50 ,, |
| Coconut Oil ... ... | 0.85 ,, | 24 ,, |
| Coconut ... ... | 1.50 ,, | 42 ,, |
| Tea ... ... ... | 0.12 ,, | 3.4 ,, |
| Salt ... ... ... | 0.1 ,, | 2.8 ,, |

In a recent publication Dr. H. Schaumann [9] has dealt with the composition of this diet, and quotes the results in support of his view that the disease beri-beri is due to a diet defective in substances having a high organically-combined phosphorus content.

As Dr. Schaumann has assigned values to the

various foodstuffs comprising this diet which differ from those given by us, it would appear that he had not before him a copy of the publication in which these were furnished, namely, No. 10 of this series, published in 1909. Also as the authorship of the paper published in *The Lancet* (1909, No. 4,459, p. 451) is wrongly quoted throughout the text, it may be assumed that Dr. Schaumann had not an opportunity of consulting it in the original. In these circumstances we venture to direct attention to some errors into which we believe Dr. Schaumann has fallen.

The analyses upon which our calculations were based were carried out with the actual foodstuffs employed, and were not taken upon the authority of a text-book on dietetics. We feel called upon to make this explanation as a protest against the use of analyses of foodstuffs given in text-books, however eminent the authority, for the calculation of the relative values of diets. As we shall hope to show later, fundamental differences may exist in the nutritive value of various combinations of foodstuffs which are not revealed by the ordinary methods of analysis, and there are factors in the composition of food which are of much more complex nature than its protein, fat and carbohydrate content or its calorific value.

Observations have shown that beri-beri is definitely associated with the continuous consumption of a diet of which white rice is the staple, and must be due either to a poison contained in white rice or to a deficiency in such a diet of some element of high physiological value. If the latter, then accuracy is imperative, and can only be attained by an analysis of the actual foodstuffs eaten by those among whom the disease occurred. So far as we are aware, such an opportunity has only been afforded by our planned observations extending over twelve months, and which are now under discussion.

The various articles composing the diet issued were submitted to analysis in this Institute by Mr. B. J. Eaton.

The average of a considerable number of analyses was as follows:—

| | Moisture Per cent. | Protein Per cent. | Fat Per cent. | Carbohydrate Per cent. | Ash Per cent. |
|---|---|---|---|---|---|
| White rice.. .. | 13.85 | 7.45 | 0.17 | 78.02 | 0.51 |
| Parboiled rice .. | 14.03 | 7.8 | 0.53 | 76.92 | 0.72 |
| Dried salt fish .. | 48.1 | 35.7 | 2.96 | — | 13.24 |
| Onions .. .. | 86.44 | 1.5 | 0.28 | 11.28 | 0.5 |
| Potatoes .. .. | 65.3 | 1.8 | 0.2 | 31.66 | 1.04 |
| Coconut .. .. | 45.3 | 3.95 | 34.6 | 15.2 | 0.95 |

Based on these analyses, the diet issued to those on white rice as the staple was calculated to consist of:—

| Protein | Fats | Carbohydrate | Salts |
|---|---|---|---|
| 91.45 grm. | 43.70 grm. | 499.16 grm. | 23.06 grm. |

The diet issued to those on parboiled rice was calculated to consist of:—

| Protein | Fats | Carbohydrate | Salts |
|---|---|---|---|
| 93.56 grm. | 45.88 grm. | 492.54 grm. | 24.33 grm. |

Dealing with this diet, Dr. Schaumann, on p. 79 of his monograph, gives a table which shows, assuming white rice to contain 7.8 per cent. protein, that the diet received by those on white rice contained 103.7 grm. of protein, whereas calculated from the analyses of the actual foodstuffs supplied this diet contained 91.45 grm. of protein. Again on p. 81, assuming parboiled rice to contain 9.05 per cent. protein, he states that the diet of those on parboiled rice contained 111 grm. of protein or 7.3 grm. *more* than that contained in the white rice diet, whereas the fact is that the parboiled rice diet contained 93.56 grm. of protein, or 2.1 grm. more than that contained in the white rice diet.

Again on p. 339, Dr. Schaumann compares the diet of those on parboiled rice with that of those on white rice. The analysis of the foodstuffs there given differs materially from the analysis of the actual foodstuffs issued. By his calculations Dr. Schaumann now shows that those consuming the parboiled rice diet receive *less* protein than those consuming the white rice diet, as he here takes it that parboiled rice contains less protein than white rice (6.38 per cent. protein for parboiled rice and 7.03 per cent. protein for white rice) which is not in accord with the statement made previously by him.

On p. 363, Table XII, Dr. Schaumann gives the composition of the various foodstuffs in respect of protein, fat, carbohydrate, fibre, total ash and phosphorus pentoxide, these he takes as the basis for his final calculations.

It is possible that a parboiled rice may be found which yields 2.08 per cent. of fat and 3.57 per cent. of ash, but among the numerous specimens examined in this Institute we have not met with such a rice.

Whatever methods of analysis are employed, it may well be that the defect of nutrition, which we regard as the cause of beri-beri, will escape observation, but certainly it appears that when the actual foodstuffs issued in a diet are not the subject of analysis, the results are not likely to help materially towards a solution of the problem of beri-beri causation. The valuable work which Dr. Schaumann has accomplished in this domain of research would in our opinion have been greatly enhanced in value had the opportunity been available to him of studying the actual dietary conditions under which beri-beri arises.

It is generally accepted that the dietary requirements per kilogramme of body weight are protein 2 grm., fat 1.5 grm., carbohydrate 6 grm., salt 0.5 grm. The average body weight of the people under our observation was 100 lb. nearly—the diet should therefore contain—

| Protein | Fat | Carbohydrate | Salt |
|---|---|---|---|
| 90 grm. | 68 grm. | 272 grm. | 20 grm. |

Comparison of this calculated standard diet with the diets consumed by the persons under observation will show that the issued diets cannot be

regarded as deficient save in respect of fats. This latter deficiency is, however, more than compensated for by the excess of carbohydrates. With a sufficiency of protein in a diet, fats and carbohydrates are to a great extent interchangeable, and the inhabitants of warm countries habitually consume less fat and more carbohydrate than do the inhabitants of cold countries.

It will be noted that the analyses of these foodstuffs did not include an estimation of the relative proportions of the inorganic salts composing the ash, nor did they take account of the manner of combination, organic or inorganic, in which these substances originally existed in the rice grain. This matter will be referred to in some detail at a later stage of this report.

The conclusions arrived at as a result of this inquiry were stated as follows:—

(1) In the course of a systematic inquiry especially undertaken to test the position of white rice as a causative agent in beri-beri it was observed that twenty cases of this disease occurred among 220 people on white rice who were continuously present in the various parties during the course of the outbreaks. In the parties on parboiled rice during the same periods and under similar conditions, among 273 people no sign of the disease appeared.

(2) Since all cases presenting doubtful signs of the disease were excluded, we are of opinion that there were many other cases which in the ordinary routine of clinical practice would have been regarded as beri-beri. Such cases only occurred among people who consumed white rice, and their inclusion would not strengthen the case for an infectious origin of the disease.

(3) No case of beri-beri occurred in any person who had been on white rice for less than eighty-seven days.

(4) Systematic examinations were made of the blood and urine of patients suffering from beri-beri. Various methods of examination were employed, but in no case were organisms found other than those well known as the causative agents of other diseases.

(5) In the course of the inquiry patients in various stages of beri-beri were in contact with parties of men on parboiled rice. The results of observations made on such occasions furnished evidence that the disease is not a communicable one.

(6) Removal of patients from the place where they had contracted the beri-beri did not influence the progress of the disease and the removal of entire parties from the place where the disease had occurred did not influence the progress of an outbreak so long as they continued on white rice. These observations suggest that place *per se* or considered as a nidus of infection has no influence upon the development of beri-beri.

(7) In three instances in which definite outbreaks of beri-beri occurred among parties of men on white rice, substitution of parboiled rice was followed by cessation of the outbreak.

(8) The occurrence of beri-beri cannot be attributed to deficiency in the diet issued in respect of either protein, fat, carbohydrate or salts as estimated by the methods in common use.

(9) No evidence was obtained to show that any article of the diet other than white rice was responsible for the occurrence of beri-beri.

(10) Ankylostomes and other nematode worms were not found in a larger proportion of patients suffering from beri-beri than in the general population under observation.

(11) The general results support the view that the disease beri-beri as it occurs in the Malay Peninsula has an intimate relationship with the consumption of white rice, and further research along these lines is justified.

On April 26, 1909, Dr. J. D. Gimlette reported to the Senior Medical Officer, Selangor, that a number of Malays recently enlisted into the Police Force and then stationed at the depôt, Kuala Lumpur, had reported themselves sick. On examination Dr. Gimlette had found that they were suffering from beri-beri. He adds: "The occurrence is of interest because it has been possible to recognize the disease in an early stage. The majority of those attacked are newcomers who have recently fallen ill while their rice (No. 2 Siam) has, I understand, only recently been supplied through a new sub-contractor. The patients are all Malays with one exception, a Javanese."

The rice was changed from white polished rice to parboiled rice on April 27, and on June 2 Dr. Gimlette reported that the occurrence of the disease had ceased, and that no deaths had occurred among those suffering from beri-beri.

Throughout the course of the inquiry at Durien Tipus, samples of the white rice issued were collected daily and forwarded to the Institute.

Through the courtesy of Dr. Gimlette and Dr. Freer, Senior Medical Officer, Selangor, we were enabled to obtain a bag of the white rice which was in use at the depôt at the time of the outbreak of beri-beri.

So far as the laboratory aspect of the question was concerned therefore an abundant supply of the rices which actually caused these outbreaks of beri-beri was secured. In connection with the plan of work which we had formed, we regard this circumstance as of the first importance. It could have led to no real advance in knowledge if analyses of a series of rices from various sources had been carried out without regard to their connection with outbreaks of beri-beri. Having first shown that the consumption of a certain white rice was the cause of an outbreak of beri-beri, we were in a position to proceed further and by analysis of and experiments with that rice, to seek for the explanation of this relationship. The continuity of work thereby established we believe to be one of the principal merits of the observations here recorded.

## Rice.

### *General.*

The cultivation of rice has existed from ancient times. It is a cereal indigenous to certain areas in both hemispheres, but its culture now extends over wide areas in tropical and subtropical countries possessing an assured and heavy rainfall; also, with the aid of irrigation, cultivation has been extended to areas not possessed of a sufficient rainfall.

The operation of these factors has produced many species and varieties of rice, so that their number is now very great. We are not in a position to treat this subject in a comprehensive way, and must of necessity confine our remarks to the countries and their rices which have come under our immediate observation.

In the Straits Settlements and Federated Malay States a limited amount of rice is grown. The quantity is quite inadequate to supply the demand of a country which is rapidly and extensively being opened up, and therefore supplies have to be imported from the great producing countries, more especially Siam, Burma, and French Indo-China.

Rice is derived from the fruit, botanically a caryopsis, of plants belonging to the genus Oryza.

The product as it reaches this country is in the form of unhusked fruit, the partially husked fruit, or the finished product rice.

The imported unhusked or partially husked grain is converted into rice in the mills of Penang and Singapore. So far as can be ascertained, the principal reason for the importation of the unfinished product is in order that parboiled rice may be prepared locally and sold at a lower price than the parboiled rice imported from India. The local mills are, of course, adapted to the production of ordinary white rice, and the question as to which variety of rice a mill shall produce is answered by the demand.

The indigenous natives (Malays) in the country districts grow the grain in quantities sufficient for their own requirements, and from it prepare the rice by primitive methods of pounding and winnowing.

The Oriental immigrants, natives of India, China, and Java, come to this country either as workers on mines or on estates, and therefore have not the opportunities for growing the rice they require. The immigrant Indians are for the most part recruited from the South of India, and prefer parboiled rice, which must be cheap. It is to meet this demand that the large rice mills of Penang, Singapore, and Perak have been called into existence. The natives of China and Java prefer a rice which has not been parboiled, and for their requirements the grain is husked and polished by machinery. The product is commercially known as Rangoon, Siam, or, as we prefer to call it here, white rice.

The kinds or forms of rice used in this country may therefore, for purposes of this account, be grouped under three divisions—parboiled rice, native or Malay rice, and white rice.

### *Parboiled Rice.*

As prepared in the large power-mills, the grain is soaked in water for twenty-four to forty-eight hours; the water is then run off, the grain is transferred to cylinders, which are lightly covered, and steam is passed through the contents for five or ten minutes. The grain is thereafter transferred to open paved courts and dried in the sun. The husk is now more readily detached than in the untreated grain, the contents of the grain have been rendered tough and semi-translucent.

In the milling of this parboiled grain the husk is removed and the rice is subjected to a limited amount of pearling or polishing in a machine provided with stone facings. By no process can such rice be made to appear white, consequently polishing is, as a rule, employed merely to complete the removal of fragments of husk and most of the pericarp.

Parboiled rice is also prepared on a less pretentious scale in small mills not provided with steam plant. The product is similar to that produced in the larger mills, but, in view of the insanitary conditions prevailing in many of these places, numbers of them have been compulsorily closed.

Parboiled rice prepared in this manner has a peculiar, disagreeable, penetrating odour caused by the preliminary soaking in cold water; by soaking the grain in hot water in place of cold water and for a shorter period, the occurrence of this disagreeable odour can be prevented.

Other manufacturers have sought to improve their product by subjecting the grain to more extensive polishing or pearling; as will be shown later, this may be attended with dangerous results to those who consume such a highly-polished parboiled rice as the staple of their diet.

According to Hooper [10], rice in Bengal is treated before husking by three methods:—

(1) Hot water is sprinkled over the padi.

(2) The padi is soaked in cold water for twenty-four hours.

(3) The padi is first soaked in water and afterwards it is boiled.

In each case the padi is thereafter dried in the sun or by other means. When the grains are sufficiently dry they are husked in a pestle and mortar.

Watt [11] states that "in India a large part of the rice sold in shops and exported to Europe as an article of food has been prepared by being first half boiled, then dried in the sun, and finally husked by the ordinary pestle and mortar. Such rice is in trade termed 'parboiled.' Husking without boiling is a very tedious process when done by hand."

According to the same authority, in India proper power mills for the preparation of rice are very few

in number. In 1904 there were in all India 127 rice mills, with 17,814 employees, and of this number 114 mills, with 17,016 employees, were located in Burma.

Parboiled rice prepared in India has no objectionable odour. It is imported into this country to a limited extent for consumption by the more affluent natives of India.

The objectionable odour possessed by the locally prepared parboiled rice has hitherto militated against the more widespread use of this kind of rice by others than natives of India, and if the consumption of parboiled rice is to be encouraged, such improvements in the process are required as will produce a rice similar to the parboiled product of India.

*White Rice.*

In the milling of white rice in large power mills the padi is first deprived of the husk. This is done by passing it into a machine called the " huller, ' which consists of two iron discs faced with a cement of which emery is one of the ingredients. The padi enters in a stream at the centre, and is driven by centrifugal action between the discs to the periphery. By this means the husk is cracked. The mixed rice and husk are now passed over the winnowing fans, which blow away the husk.

The grain, still covered with its brown, yellowish, or other coloured pericarp, now passes to a machine in which the whitening process takes place. This machine consists of a conical drum revolving at a high velocity; the drum is faced with emery, and is surrounded by a casing lined with steel wirecloth. In the more modern mills the space between the cone and the wirecloth through which the rice passes can be altered by vertical adjustment of the spindle, so that the necessary amount of attrition of the rice is secured and the desired amount of milling attained. In this process the fruit wall or pericarp, the layers subjacent to it (the subpericarpal layers), as well as the embryo, are removed.

The whitened grain now passes to the polisher, which consists of a revolving conical drum covered with strips of sheepskin, the whole being surrounded by a casing lined with wirecloth. The polishing is accomplished by the rice passing down between the sheepskins and wirecloth.

In the milling and polishing machines the rice meal or " polishings " passes through the wirecloth casings and is collected. Rice polishings are commonly used as a foodstuff for cattle and pigs. We are informed that the natives in the neighbourhood of the rice mills in Burma consume rice meal in the form of gruel.

White rice is graded commercially as Rangoon and Siam, also in accordance with the unbroken condition of the grains as No. 1 quality, or the grain mixed with broken grains as No. 2 quality, and so on. Siam rice of the best quality is a long slender grain, almost white and free from dust. Rangoon rice of the best quality is a shorter and more plump grain, white and free from dust.

We should be glad if it could be made clear that in using these trade terms we do so merely as a convenience and with no intention to suggest that the padi produced in Indo-China or Siam is inferior to that produced elsewhere. Misapprehension has arisen in commercial circles as to the significance of these researches and the matter has even been the subject of correspondence between the various Governments. At the local agri-horticultural exhibitions *Padi Siam* and *Padi Rangoon* grown locally are exhibited among a host of others. A certain type of grain in commerce has come to be associated with these names and in our use of the terms we do not mean to suggest that they necessarily indicate the country of origin of the rices used in our experiments. With the important questions of the nutritive values of different kinds of padi and the influence thereon of soil, climate, and methods of cultivation we have not concerned ourselves.

*Malay or Native Rice.*

This is prepared from the grain grown by the Malays and the preparation of the rice is almost invariably carried out by the women who prepare it in quantities sufficient for the immediate wants of the household. The grain is sun-dried and transferred in suitable quantities to a wooden mortar fitted with a long wooden pestle. The grain is pounded until the husks are detached and these are removed by winnowing. By repeated pounding and winnowing the husk is entirely removed as well as the pericarp for the most part and the subjacent layers only to a limited extent by attrition and bruising.

The finished product is yellowish and is an admixture of broken and unbroken grains.

By repeated pounding and careful hand-picking it is possible to obtain a fairly white rice free from unbroken grains, but the labour entailed is considerable and the natives are usually quite satisfied with a rice from which the entire husk and the most of the pericarp have been removed.

*Histology.*

In order to compare the different kinds of rice as to their histological characters and in order to examine rices from beri-beri outbreaks for the presence of organisms, it was necessary to obtain entire sections of the grain of sufficient thinness.

The following process was devised and found to yield suitable sections.

The grains are softened for a month or thereabouts in a mucilage composed of:—

| | |
|---|---|
| Gum acacia ... ... ... ... | 4 parts. |
| Solution of carbolic acid (1-20) ... | 6 ,, |

The softened grains are freed from excess of mucilage and embedded in celloidin. The embedded grains are placed in alcohol (60 per cent.) and after a few days are ready for cutting.

Sections were examined for moulds and for this purpose were stained by the following method:—

(1) The sections were stained in aniline-gentian violet solution for from five to ten minutes.

(2) The sections were freed from excess of stain and treated with Gram's iodine solution for one minute.

(3) The sections were freed from excess of iodine solution and washed in absolute alcohol so long as stain continued to come away.

(4) The sections were then treated with aniline oil for five minutes. After which the excess of oil was removed and the sections mounted in Canada balsam.

Plates I, II, and III are drawn from actual specimens and reproduce the coloration taken up by the various tissues by this method.

Numerous sections from various kinds of rice were examined in this way. In none of them were moulds or fungi recognized, but the method produced excellent differentiation of the tissues and it was easily possible to understand and appreciate the histological differences between padi, parboiled rice, white rice, and Malay rice.

A transverse section of a rice grain, from which the paleæ (husk) have been removed, shows three zones (Plate I):—

(1) The outer thin pericarp.

(2) The layers subjacent to the pericarp, or sub-pericarpal layers, composed of cells filled with aleurone and fat and comparatively free from starch grains.

(3) The remainder of the section, constituting the major part of the section, is composed of cells filled with starch grains.

If sections of rice grain be treated with any of the ordinary stains for fat such as osmic acid, Sudan III, it will be seen that fat is practically confined to the second zone or sub-pericarpal layers; a few scattered oil globules may be recognized in the central or starch zone.

Section of a polished rice grain (Plate II) shows that the pericarp and most of the sub-pericarpal layers have been removed. There is usually but a remnant of the fat containing layer and at times not even that remains, the section consisting almost entirely of the starch-containing cells.

Section of parboiled rice (Plate III), which has not been subjected to excessive pearling or polishing, show the pericarp mostly removed, but the subpericarpal layers practically unaffected.

Sections of Malay rice present an appearance similar to that presented by section of the grain free from husk, but the pericarp is removed to a degree the extent of which depends on the amount of pounding and attrition to which the grains have been subjected.

### *Chemical.*

In view of the accumulated mass of evidence which shows that the continuous consumption of rice from which the subpericarpal layers have been removed by polishing causes beri-beri, and in view of the histological differences demonstrated between polished and unpolished rices, the suggestion presented itself that by the removal of the subpericarpal layers the grain is deprived of some important nutritive substance or substances.

Analyses were made of the various kinds of rice, and for comparison the average results of these analyses are given here:—

| | Protein Per cent. | Fat Per cent. | Carbohydrate Per cent. | Ash Per cent. | Moisture Per cent. |
|---|---|---|---|---|---|
| Unpolished rice .. | 9.0 | 1.65 | 75.52 | 1.08 | 12.75 |
| Polished rice.. .. | 7.7 | 0.25 | 77.23 | 0.52 | 14.3 |
| Parboiled rice .. | 7.8 | 0.50 | 76.88 | 0.82 | 14.0 |
| Malay rice .. .. | 7.3 | 0.63 | 77.19 | 0.88 | 14.0 |

The average daily ration of an Oriental labourer contains 1.3 lb. of rice.

Dealing first with the differences in respect of proteins, that between parboiled and polished rices is small and within the limits of experimental error, but admitting the difference to be a real one and assuming all the protein in rice to be available for purposes of nutrition, a person receiving parboiled rice would consume 9 gr. more protein than one receiving polished rice, and a person receiving Malay rice would consume 36 gr. less than the one on polished rice. An explanation on this basis would therefore not be in accordance with the effects produced.

The amount of fat ingested in a ration of 1.3 lb. of rice would be 45.5 gr. in the case of parboiled rice, 22.75 gr. in the case of polished rice, and 57.25 gr. in the case of Malay rice—differences which are appreciable and in accordance with the histological findings, but which do not appear to furnish an adequate explanation, if the fats be regarded merely as the esters of fatty acids.

The differences in respect of carbohydrates is small; parboiled rice contains more sugar than polished rice or Malay rice, but it did not appear that these differences would furnish an explanation.

The ash furnishes a most imperfect idea of the salts contained in rice, all the organic salts being reduced to carbonates, but there is apparently a very constant difference in the amount of ash, which is lower in the case of polished rice than in unpolished, parboiled, or Malay rices. A person receiving parboiled rice would consume material yielding 74.6 gr. of ash, and a person receiving polished rice would consume material yielding 47.3 gr. of ash. The difference of 27.3 gr. is by no means inconsiderable, more especially when it is remembered that small amounts of certain inorganic and organic salts have a great importance in the economy.

As we were not in a position to separate out the various salts occurring in rice, and it seemed possible then that, even if we did accomplish this, the results might be unsatisfactory, it was decided to carry out investigations with a view to determining whether a poison or poisons existed in

polished rices known to have been associated with outbreaks of beri-beri.

As has been already stated, the white and the parboiled rices milled in this country have a common origin in respect of the grain from which they are prepared; therefore any deleterious substance or substances present in the white rice must have developed after polishing, and have resulted from the action either of enzymes or of micro-organisms, failure to find these latter notwithstanding.

It has been suggested that the removal of the pericarp and subjacent layers deprives the grain of protective structures and facilitates the action of micro-organisms.

Rice is washed before cooking, and the cooking involves exposure to a temperature of 212° F. or thereabouts for some time; therefore the ingestion of living organisms with the rice may reasonably be excluded; their activity is confined to the interval which elapses between the milling and the cooking of the rice, and the deleterious substance or substances produced by them must be capable of withstanding prolonged exposure to moist heat.

It might be suggested such harmful substances would be removed in the preliminary washing, but the extent to which this washing is carried out varies greatly, and, not infrequently, it is done in a perfunctory manner.

In the initial experiments for the isolation of a poison the white rice was macerated, or boiled and macerated, in water acidulated with a small quantity of acetic acid, but on account of the rapidity with which moulds developed in the mixture and the difficulty of separating the fluid after maceration, these experiments were discontinued.

In the next series of experiments alcohol acidulated with acetic acid was employed. The alcoholic extracts were concentrated *in vacuo*, and finally freed from alcohol by exposure in evaporating basins to a moderate heat. The extracts were then examined, and treated in every way possible for the isolation of poisons, but although numerous examinations and experiments were made, a poison or poisons were never isolated. The failure to obtain a positive result did not exclude a poison, but when it is remembered that a large number of methods were employed, it is suggestive that further work along these lines was unlikely to be profitable. We had already noted nutritive differences in the rices which in the light of our then knowledge we did not consider adequate to furnish the explanation sought for, but failure to find a satisfactory result on a poison hypothesis caused us to turn our attention to further experiments on the nutritive hypothesis.

Failing chemical methods there remained animal experimentation, and it was anticipated that by feeding various animals on rice and rice products, information of value might be obtained.

*(To be continued.)*

## ON THE CULTIVATION OF MALARIAL PARASITES *IN VITRO* BY PREVENTING THE DEVELOPMENT OF COMPLEMENT IN THE HUMAN BLOOD EMPLOYED.

By C. C. Bass, M.D.

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*(Study No. 4. From the Laboratory of Tropical Medicine and Hygiene, under the Direction of Creighton Wellman, Tulane University of Louisiana.)*

In my recent preliminary note* on this subject I announced successful cultivation of the human malarial parasites *in vitro*, and in the present paper repeat part of that note, together with additional observations and experiments to date.

In the beginning of this study let us refer to the well-known theory that lysis of protoplasm, either protozoal or bacterial, by the body fluids, depends on two substances: (1) Amboceptor, which is generally specific, but may sometimes be common; and (2) complement, which is common with reference to antigen, but is more or less specific with reference to the source of amboceptor. This complement is more active with specific amboceptors in man's serum than with specific amboceptors in the serum of other animals.

When a foreign protoplasmic substance, protozoal or bacterial, is introduced into the tissues of men, specific amboceptors develop and may be demonstrated in the body fluids, especially the blood-serum. These amboceptors are capable of dissolving large quantities of the same kind of protoplasm in the presence of sufficient complement, but are inactive in the absence of complement. Amboceptors are not destroyed by moderate heat (56° C.) or by considerable age.

Complement acts with specific amboceptors to dissolve and destroy large quantities of protoplasm in the presence of specific amboceptors against particular protoplasm, but it is inactive in the absence of such amboceptors. Human complement capable of acting with human amboceptor to produce lysis, though generally supposed to require at least moderate heat to inactivate or destroy it, as a matter of fact is destroyed by any temperature above normal body temperature (37° C.), and with a rapidity depending on the temperature. A temperature at 40° C. (104° F.) destroys the complement in human serum in from fifteen to thirty minutes, and prevents lysis regardless of the amount of amboceptor employed.

Freshly drawn human blood contains little or no complement capable of acting with human amboceptors, but under favourable conditions it develops at a variable rate and in varying quantities, depending especially on the temperature at which

* *Journal of the American Medical Association*, November 2, 1911.

the blood is kept. The most favourable temperature is considerably below body temperature. Little or no specific complement develops at ordinary fever heat, 38 to 40° C. (101 to 104° F.), such as obtains locally and often generally in most inflammations. Bacteriolysis or protozoolysis, by far the most important of the known protective processes of the body fluids of man through which the specific infecting organism should be destroyed, is thus prevented by the local or general temperature regardless of the amount of amboceptor present.

In the event that human complement has developed in a blood (which it does under favourable conditions within a few hours), it increases in amount for a time. Then it again disappears in from thirty to seventy-two hours, according to various conditions.

When an individual is infected with the malarial plasmodium, *Spirochæta pallida*, the bacillus of typhoid, &c., his blood soon contains large amounts of amboceptor against the infecting organism. If such blood is drawn and employed as a blood-culture in the usual manner and at a temperature at or below 37° C., complement develops within a few hours, and acting with the specific amboceptor destroys the organism and prevents successful cultivation. This is the explanation for the many negative typhoid blood-cultures in the latter part of the disease when much amboceptor is present, while cultures in the first few days are generally successful. This may be obviated to some extent by employing special media-like bile, which prevents the development of, or fixes complement. The same result can be obtained by placing the culture immediately at a temperature that will prevent the formation of complement, and yet not high enough to destroy the organism. Theoretically and practically, so far as my experiments indicate, blood-cultures will be positive at any time when the organism is present in the blood.

Applying the principles set forth above, I have been able to keep alive and to cultivate without difficulty the three common forms of malarial plasmodia—*Plasmodium vivax*, *P. malariæ*, and *P. falciparum*. They have been repeatedly transplanted successfully. Cultures have, up to the present writing, lived in citrated blood for about three weeks (twenty days). The viability of my cultures has been confirmed by a number of my *confrères* here.

It is my opinion that the other blood-inhabiting protozoa and bacteria may be grown without difficulty, provided these principles are followed and appropriate technique is employed. In the case of malarial plasmodia a special technique apparently necessary is that strict anaerobic conditions must be maintained throughout. This, however, is no doubt essential for the satisfactory cultivation of most pathogenic protozoa. Citrated or defibrinated blood is the most successful medium I have found for the cultivation of malarial parasites.

The possibilities along the lines suggested are so great and the work necessary for the evolution of technique adapted to each of the many problems, both cultural and therapeutic, that will be suggested from time to time, and in which this theory plays a part so extensive, that one worker will be unable to do any considerable part, and I, therefore, hope that others will take up this line of experimentation and confirm or contradict the opinions here expressed.

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A NEW CHROMATIN STAIN.—In the *Yellow Fever Bureau Bulletin*, vol. i., No. 6, October, 1911, Dr. Harold Seidelin gives Mentz von Krogh's new method for chromatin staining. [" Eine Neue Methode zur Chromatinfärbung." Mentz von Krogh. *Centralbl. f. Bakt., Parasitenk. u. Infektionskrankh.*, Abt. i., Orig. lviii., pp. 95-96.]

The method described is specially recommended for sections of the central nervous system. Dr. Seidelin quotes it because, as he says, comparative methods for the staining of chromatin must play a great rôle in parasitological studies on yellow fever. The method, however, he believes, does not seem likely to become of great importance in this particular work, since the presence of numerous cell nuclei and erythrocytes prevent good results being obtained. It must also be considered a drawback to the method that chromatin is only characterized from other elements by a deeper tint, but not by a different colour. The method would, therefore, correspond more closely to a hæmatoxylin stain than to " specific " chromatin-staining methods, such as Romanowsky's. It has also, in common with most techniques which are applied to sections, the inconvenience of uncertainty inherent to all procedures of which differentiation forms a part.

Dr. Seidelin states that the fixation employed is not indicated, and it may, therefore, he thinks, be assumed that all ordinary fixing methods can be used. This would be a distinct advantage in comparison with Giemsa's and similar stains.

The technique is as follows:—

" Thin paraffin sections are:—

" (1) Stained in Unna's polychrome methylene-blue (from Grübler) for five minutes,

" (2) Rinsed in tap-water,

" (3) Mordanted in 2 per cent. solution of chromic acid for one to fifteen minutes,

" (4) Rinsed,

" (5) Differentiated in 5 per cent. solution of tannin, until they appear light blue with a red-purplish tint,

" (6) Again rinsed,

" (7) Dehydrated as quickly as possible in absolute alcohol, then passed through xylol to Canada balsam."

Different preparations of tannin show very different intensities of action; each preparation must, therefore, be subjected to tentative essays.

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THE JOURNAL OF

# Tropical Medicine and Hygiene

NOVEMBER 15, 1911.


## A NEW EXPEDITION FOR THE STUDY OF SPRUE.

THE London School of Tropical Medicine propose to send out an expedition to Ceylon for the study of sprue. Dr. P. H. Bahr, who has just returned from Fiji, where he has been investigating dysentery and filariasis, will be in charge of the work, and it is hoped that a start will be made in the beginning of next year. The Ceylon Government and the Planters' Association are taking a financial interest in the expedition, and they have arranged that the School should send it out. The disease is certainly one of the greatest importance to the Island of Ceylon, and no efforts should be spared in attempting to elucidate its etiology. Many problems, epidemiological and otherwise, will have to be faced, but given time and suitable opportunities there is no reason why Dr. Bahr should not succeed in his quest. It is fitting that some mention should be made here of the valuable research work the London School of Tropical Medicine has accomplished in the many expeditions which it has now sent abroad. The first expedition consisted of Drs. Sambon and Low, who conducted an important malarial experiment in the Roman Campagna. This work conclusively proved that if one avoided the bites of mosquitoes one could live perfectly well in an intensely malarial region without acquiring the disease. Dr. Low, on his return from the Campagna, then proceeded to the West Indies to study filariasis. He went out as the Craggs Scholar (a scholarship presented to the London School of Tropical Medicine by Sir John Craggs) and spent about a year and a half in these parts, visiting the different islands and British Guiana. In addition to special work on the geographical distribution of the different species of filaria, their intermediate hosts, and the diseases they produce, he advocated the destruction of domestic mosquitoes (*Culex fatigans*) as being the only way of eradicating and stamping out this loathsome disease. Though these suggestions were not at once adopted, they have since been taken up and acted upon and incidentally have helped in the prophylaxis of yellow fever. In 1902, Drs. Low and Castellani went out from the London School of Tropical Medicine in conjunction with the Royal Society and Foreign Office, to Uganda to study sleeping sickness. Dr. Low disproved the idea that the *Filaria perstans* had anything to do with the etiology of the disease, and later on Dr. Castellani demonstrated the true cause by discovering the presence of trypanosomes in such cases.

Dr. Philip Ross, in conjunction with Dr. Milne, of Uganda, studying tick fever, a disease very prevalent in East Africa, on the spot, proved that a spirochæte was the causative agent of the disease, and later Dr. Catto, working at the London School of Tropical Medicine on material brought home from Singapore, independently discovered the *Schistosomum japonicum*, a bilharzial-like parasite, frequently found in man in the East. Passing to more recent years, Dr. Leiper, the Helminthologist to the School, was sent to the West Coast of Africa to study the Guinea worm. By a series of very interesting experiments he showed that infection by this parasite is due to the ingestion of infected cyclops (water fleas) in water, the hydrochloric acid in the stomach stimulating the contained metamorphosed worms to escape. Quite recently Dr. Wenyon has returned from Bagdad and Aleppo, where he has been studying the mode of propagation of "Oriental Sore" with considerable success; and lastly, Dr. Bahr, as already mentioned, has now returned from Fiji after investigating filariasis and dysentery. His report, which is not published yet, contains many observations of great interest. From this brief résumé of the work done by the London School of Tropical Medicine it will be seen how many lands have been traversed and how much valuable research has been accomplished. The method of studying diseases on the spot is the correct one, and all tropical workers, we are sure, will wish that the coming expedition on sprue will be as successful as those that have gone before.

# Abstract.

## ORIENTAL SPECIES OF STOMOXYS.*

A COLLECTION of about three hundred specimens of *Stomoxys* was kindly sent to the London School of Tropical Medicine by Mr. H. C. Pratt from Kuala Lumpur. Miss S. L. M. Summers, who received and described these, states that there are five species in this collection, but only one of them is new. These flies were no doubt collected indiscriminately, so it is interesting to note the numbers of the different species. The most numerous seem to be the *Stomoxys calcitrans*, Linné, and *Stomoxys oblongopunctata*, Brunetti. There are nearly one hundred of each of these. The next in number is *Stomoxys nigra*, Macq.; of these there are over forty. There are about forty specimens of a new species, *Stomoxys pratti*, but of *Stomoxys limbata*, Austen, there are only eleven specimens. There are male and female in every species.

The species of *Stomoxys* are difficult to recognize. So much depends on the way the light is shining on them, and they seem to vary so much in the different lights, that it is difficult to get a suitable basis for a table. In going over this collection Miss Summers found that the characters most to be relied on were: (1) The width of the frons in relation to the width of the head; (2) the width of the median line on the thorax; and (3) the colour of the legs. The abdominal markings can be relied on to a certain extent only. In *S. calcitrans* the spots on the abdomen may vary considerably, but the species can be easily recognized by the broad frons, the narrow stripe on the thorax, and the black legs.

Since the determination of the species depends to a large extent on the breadth of the frons and of the median stripe on the thorax, it is imperative to get exact measurements. One can get these measurements exactly by making a camera lucida tracing of the head and thorax of the specimen, using a two-inch lens, and then measuring the drawing. The measurements of the frons in this paper are taken at the vertex. The colouring of the face is not constant, and therefore cannot be used as a definite character. In some species the colour of the tibiæ may vary; *e.g.*, in *S. nigra* four samples were found with quite brown tibiæ (in the second pair of legs). These four agree with the type of *S. nigra* in every other respect, and the light colour of the tibiæ of the second pair of legs is not sufficient to make a new species of these specimens. Besides, Grünberg, in his description of *S. glauca*, which has since been shown to be a synonym of *S. nigra*, Macq. (Austen), remarks that sometimes the tibiæ are *quite brown* (Grünberg, 1907, "Die blutsaugenden Dipteren").

In his revision of the Oriental blood-sucking Muscidæ (*Records of Ind. Mus.*, vol. iv., No. iv., 1910) Mr. Brunetti gives a table of the Oriental species of stomoxys, but *S. Nigra* is not included.

The following table is drawn up according to the characters aforementioned:—

TABLE OF ORIENTAL SPECIES OF STOMOXYS.

A. Legs mainly black ... .... 1.
B. Legs mainly brown ... ... 2.

(1) Legs mainly black.

1. Frons in ♂ wide, ¼ or ⅓ width of head ... ... ... 3.
   Frons in ♂ narrow, ⅛ or less width of head. Abdomen with round spots ... ... *sitiens*, Rond., ♂.
3. Dorsal stripe on thorax narrow (3.5 mm.) at anterior end, widening towards the posterior end. Abdomen spotted 4.
   Dorsal stripe on thorax wide (·75 mm.) uniform in width. Abdomen banded ... ... *nigra*, Macq.
4. Spots round ... ... ... *calcitrans*, Linné.
   Spots triangular, apex pointing edge of segment ... ... *triangularis*, Brunetti.
   Spots elongate ... ... ... *oblongopunctata*, Brunetti.

(2) Legs mainly brown.

2. Frons wide, ¼ or ⅓ width of head 5.
   Frons narrow, ⅛ to ⅕ width of head ... ... ... ... 6.
5. Abdomen distinctly banded ... 7.
   Abdomen blotchy. Dark species. Fore tarsus in ♂ with first joint fringed on the inside with a row of hairs of equal length. (♀ unknown) ... *pulla*, Austen.
7. Hind border of first three abdominal segments with black band. Femora clove-brown, hind tibiæ ochraceous buff, frons and middle tibiæ and tarsi mummy-brown. Width of frons ⅓ in ♂, almost ¼ in ♀. Frons in ♂ constricted in the middle .. ... *limbata*, Austen.
   Dorsum of second abdominal segment entirely clove-brown, deep posterior transverse band on third segment. Frons and middle tarsi pale brown, width of front wider than ¼ width of head ... *pusilla*, Austen.
6. Frons ⅛ in ♂, more than ⅓ in ♀. Femora dark brown, tibiæ and tarsi very pale yellow. Abdomen seen from behind at a very low level is banded *pratti*, sp. n.
   Frons ⅛ in ♂. Interocular space very straight. Legs testaceous; coxæ black, femora brownish, anterior ones lighter on inner side, darker on outer side. Abdomen banded ... ... ... *indica*, Pic.

Mr. Brunetti includes *S. plurinotata*, Bigot, *S. dacnusa*, Speis., and *S. bengalensis* in his table. He gives as the differences between *S. plurinotata*, Bigot, and *S. calcitrans*, Linné, the following: "Thorax with four oblong large spots, each more or less divided. Width of frons (*presumably*) neither one-fourth nor one-third, as sex is doubtful." Bigot, in his description of the species,

* From the *Annals and Magazine of Natural History*, Ser. 8, vol. viii., August, 1911.

said that sometimes these four spots appeared as four longitudinal stripes. In these cases, there being no measurements given, it could not definitely be said to differ from *S. calcitrans*, so it is probably safer to leave it out of the table. *S. dacnusa*, Speis., requires a fuller description before it can be placed in a table. This species was founded on a damaged female specimen. *S. bengalensis*, Pic., is probably a synonym of *S. nigra*, Macq.; its description corresponds to the type of *S. nigra*, and also with Grünberg's description of *S. glauca*, synonym of *S. nigra*, Macq. (Austen).

The flies of this genus are medium-sized. The largest species in this collection is *S. nigra*, which measures 7.5 mm.; the smallest species is *S. limbata*, measuring a little under 5 mm.

*Geographical Distribution.*—*S. calcitrans* has a very wide distribution; it is found wherever mankind is. It is so variable that it has been described at least twenty times as a new species. *S. sitiens*, Ron., is a doubtful Oriental species (Brunetti); Rondani reported it from Abyssinia. *S. nigra* has been found in Port Natal (Macq.), Cameroons and Togo (Grünberg). *S. triangularis* from South India (Brunetti). *S. oblongopunctata* from Assam (Brunetti). *S. pulla* is reported from India (Austen). *S. limbata* from India, Assam, and Ceylon. *S. pusilla* is also from India, while *S. indica* has been met with in India, Assam, and Ceylon.

*Stomoxys pratti*, sp. n.

♂. Length almost 7 mm.; width of frons narrow, one-sixth width of the head. Width of median stripe on the thorax .5 mm. Frons not straight.

Rather a dark species. The frons is very little wider than the frontal stripe. The face and antennæ are greyish-brown.

*Thorax* has the usual longitudinal stripes in front of the transverse suture, and, if viewed from behind at a low angle, they can be traced to the middle of the thorax. They can be seen still more distinctly if the head is turned away from the light.

*Abdomen* viewed from above is dark brown; from behind at a low angle the last segment is grey, while the other segments have broad posterior bands.

*Legs.*—The femora are cinnamon-brown, the tibiæ and tarsi are a pale brownish-yellow.

*Wings* are dirty brown.

♀. Length 6 mm.; width of frons one-third the width of the head. Similar to the male, except that the tibiæ and tarsi of the legs are a very pale yellow and the femora of the last pair are black-brown.

This species is near *S. brunnipes* (an African species, Grünberg, 1906, *Zool. Anz.*, Bd. xxx., p. 89), but differs in the following points:—In the male of *S. brunnipes* the width of the frons is narrower than in *S. pratti*, being only one-eighth width of head, while *S. pratti* is one-sixth; the antennæ are black, but in *S. pratti* they are greyish-brown. The black stripes on the thorax converge in front of the transverse suture, whereas in the new species they are parallel. The coxæ, trochanters, and femora are black in *S. brunnipes*, but are cinnamon-brown in *S. pratti*.

In the female of *S. brunnipes* the broad black stripes on the thorax are nearly confluent. The abdomen is a shiny black, and when viewed from behind spots become visible on the second and third segments; in *S. pratti* the abdomen is dark brown, and when viewed from behind is banded. Coxæ, trochanters, and femora are black, whereas in *S. pratti* they are light brown, except the last pair, which are dark brown.

It is also near *S. tæniatus* (Bigot, 1887, *Bull. Soc. Zool. Fr.*), but *S. tæniatus* is much larger, being 7½ mm. in length. The front of the male of *S. tæniatus* is wider than that of *S. pratti*, and the legs are all a uniform pale yellow.

## Annotations.

*The Leucocytes in Phthisis.*—In the *Journal of the Clinical Research Association* for October, 1911, Craig contributes an interesting paper on the "Leucocytes in Phthisis." He groups the stages of the disease as follows:—

*Stage I.*—Slight initial lesion in the form of infiltration limited to the apex or a small part of one lobe. No tuberculous complications. Slight or no constitutional symptoms. Slight or no elevation of temperature or acceleration of the pulse at any time during the twenty-four hours, especially after rest. Expectoration usually small in amount or absent.

*Stage II.*— No marked impairment of function, either local or constitutional. Localized consolidation moderate in extent, with little or no evidence of destruction of tissue or of disseminated deposits. No serious complications.

*Stage III.*—Marked impairment of function, local and constitutional. Localized consolidation intense; or disseminated areas of softening; or serious complications.

The majority of cases examined by Dr. Craig came under the heading of Stage III. The following is a summary of the average blood counts made by him:—

AVERAGE BLOOD COUNTS ACCORDING TO STAGES OF PHTHISIS.

| | Stage I | Stage II. | Stage III. |
|---|---|---|---|
| Hæmoglobin ... ... | 58 % | 68 % | 63 % |
| Colour index ... ... | 0.65 | 0.72 | 0.67 |
| Red corpuscles ... ... | 4,481,500 | 4,737,000 | 4,667,000 |
| Leucocytes ... ... | 9,440 | 11,385 | 15,000 |
| Differential leucocyte count: | | | |
| Lymphocytes ... ... | 20.8 % | 12.7 % | 9.5 % |
| Large mononuclears ... | 13.8 | 12.2 | 7.6 |
| Transitionals ... ... | 7.9 | 6.4 | 8.6 |
| Polymorphonuclears ... | 54.6 | 64.8 | |
| Eosinophiles ... ... | 2.3 | 3.4 | 1.8 |
| Basophiles ... ... | 0.6 | 0.5 | 0.3 |

The two main points upon which it seems that stress should be laid, he thinks, are: (1) The earlier the stage the fewer the leucocytes; (2) the earlier the stage the more numerous the lymphocytes and mononuclears and the fewer the polymorphonuclears; whereas conversely the later the stage the more numerous the polymorphonuclears and the fewer the lymphocytes.

When an attempt was made to determine whether any of the more serious complications—such as intestinal ulceration, glandular enlargement, albuminuria with casts, or pleurisy—had any characteristic effect upon any part of the blood count, the somewhat unexpected result was found, that very slight and inconstant variations from the group average were produced by any single complication. No single complication presented a blood picture which would be sufficiently distinctive to be of any practical clinical value.

In regard to the changes that the blood undergoes whilst a patient who is under observation either improves, remains stationary, or gets worse, the following average figures for a series of cases is given:—

AVERAGE BLOOD COUNTS IN CASE OF PHTHISIS IN STAGE III., ACCORDING TO THE SUBSEQUENT PROGRESS OF THE CASE.

| | Much improved | Improved | Stationary | Worse |
|---|---|---|---|---|
| Hæmoglobin ... | 56 % | 65 % | 58 % | 62 % |
| Colour index ... | 0.52 | 0.70 | 0.67 | 0.66 |
| Red corpuscles | 5,408,000 | 4,614,000 | 4,326,000 | 4,728,000 |
| Leucocytes ... | 11,660 | 13,390 | 16,280 | 15,990 |
| Differential leucocyte count: | | | | |
| Lymphocytes... | 11.9 % | 10.4 % | 9.5 % | 6.7 % |
| Large mononuclears ... | 13.5 | 8.7 | 7.4 | 5.9 |
| Transitionals... | 9.9 | 8.9 | 7.9 | 8.3 |
| Polymorphonuclears ... | 61.3 | 68.8 | 73.5 | 77.5 |
| Eosinophiles ... | 3.0 | 2.8 | 1.4 | 1.3 |
| Basophiles ... | 0.4 | 0.4 | 0.3 | 0.3 |

It is clear, he says, that the number of leucocytes follows quite closely the degree of improvement, being lowest in the "much improved," gradually increasing in number in the "improved," and reaching the highest count in the "stationary" cases. The slight decline in the number of leucocytes in the "progressive" cases may be compared to the decrease of resistance occasionally seen in severe or overwhelming septic infections with a consequent failure of the organism to produce a leucocytic reaction.

The percentages of the various forms of leucocytes in the different classes are quite characteristic. The percentages of lymphocytes and large mononuclears are highest in the "much improved" cases, with a gradual decline in the other groups, being lowest in the "progressive" cases. The percentage of polymorphonuclears bears an inverse relation to the above, being lowest in the "much improved," and highest in the "progressive" cases.

If, therefore, one is seeing a case of phthisis for the first time, one may feel happier about it if the total leucocytes are few, and the small and large mononuclear cells are relatively many. If, on the other hand, one is watching a case in which the leucocytes have been unduly numerous, and the polymorphonuclear cells relatively high, one may be pleased if successive counts at intervals show a fall in the total number of leucocytes per cubic millimetre of blood, and a relative increase in the large and small mononuclear cells.

## Reviews.

### FOURTH REPORT OF THE WELLCOME TROPICAL RESEARCH LABORATORIES, KHARTOUM.

THE Department of Education of Sudan Government are about to publish immediately the fourth report of the Wellcome Tropical Research Laboratories, Khartoum. The third report was issued in 1908, since when a great amount of important research work has been accomplished, and the announcement that a further instalment is to be expected should arouse the keenest interest among students of tropical medicine.

The thorough examination of the conditions of tropical life, as they present themselves in men, animals, plants, and insects, is the task to which this great institution is devoted, and the fourth report, which is in three volumes, contains facts, observations, and discoveries recently brought to light. It is the actual record at first hand of new contributions to the solution of problems of deep and world-wide importance.

The edition is, however, limited, and, in order to ensure delivery of copies immediately upon publication, it is essential that orders should, without delay, be forwarded to the publishers. A prospectus post free will be sent on application to Messrs. Baillière, Tindall and Cox, 8, Henrietta Street, Covent Garden, London, W.

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## Notice.

### FAR EASTERN ASSOCIATION OF TROPICAL MEDICINE.

SECOND BIENNIAL CONGRESS, HONG KONG.

*January 20 to January 27, 1912.*

THE following is a later programme of the papers to be read at the above Congress. A previous notice on the subject appeared in the JOURNAL OF TROPICAL MEDICINE AND HYGIENE, October 16, 1911.

J. Mitford Atkinson, M.B., D.P.H., Hong Kong: Presidential Address: "The Progress of Tropical Medicine during the past Twenty-five Years."

J. C. Dalmahoy Allen, M.D., Hong Kong: "Blood-pressure."

Professor Cheng Hao, Canton Army Medical School, Official Delegate from the Government of China: Subject not yet announced.

Major Weston P. Chamberlain, M.D., Chairman of the United States Army Board for the Study of Tropical Diseases as they exist in the Philippine Islands: (1) "Prevention of Beri-beri among the Philippine (Native) Scouts by the Use of Undermilled Rice"; and in conjunction with Captain Edward B. Vedder, M.D.: (2) "The Substance in Rice Polishings which Prevents Polyneuritis Gallinarum and Beri-beri."

C. Noel Davis, M.B., D.P.H., Shanghai: "Beri-beri."

Lawrence G. Fink, M.B., Burma: "Blackwater Fever in Burma."

George A. Finlayson, M.A., M.B., M.R.C.P., Official Delegate from the Government of the Straits Settlements: "Malaria as a Factor in the Etiology of Biliary Calculi."

H. Fraser, M.D., D.P.H., Official Delegate from the Government of the Federated Malay States, Director of the Institute for Medical Research, Kuala Lumpur: "Beri-beri."

Paul C. Freer, M.D., Ph.D., Official Delegate from the Government of the Philippine Islands: "Results of the past Two Years' Work in the Study of Tropical Sunlight."

Dr. Fürth, Staff Surgeon, Official Delegate from the Government of Kiautschou: "Neuere Untersuchungen über Flecktyphus" ("Latest Researches into Spotted Fever").

G. Montagu Harston, M.D., Hong Kong: (1) "The Care of Children in the Tropics"; (2) "The Care of the Eyesight in the Tropics."

Victor G. Heiser, M.D., Official Delegate from the Government of the Philippine Islands: "Beri-beri."

C. Montague Heanley, M.B., D.P.H., Hong Kong: "The Laboratory Diagnosis of Syphilis."

Major S. P. James, M.B., D.P.H., I.M.S., Official Delegate from the Government of India: Subject not yet announced.

Gregory P. Jordan, M.B., Hong Kong: "Carbon-dioxide Snow: Its Use in Private Practice in the Tropics."

K. Justi, M.D., Hong Kong: "The Diagnosis of Malarial Fever in the Absence of the Parasites from the Peripheral Blood."

O. Müller, M.D., Hong Kong: "The Surgical Treatment of Dysentery."

J. A. F. de Moraes Palha, M.D., Official Delegate from the Government of Macau: Subject not yet announced.

Sir Allan Perry, M.D., Ceylon: "Indian Native Coolie Immigration."

J. M. Swan, M.D., Canton: "Some Rare Conditions which have been met with in the Treatment of Vesical Calculi in South China."

Richard P. Strong, M.D., Ph.D., Official Delegate from the Government of the Philippine Islands: (1) "Immunization against Pneumonic Plague"; (2) "The Etiology of Beri-beri."

H. Gordon Thompson, M.D., F.R.C.S., Pakhoi: "Surgical Work in South China."

Dr. Uthemann, Fleet Surgeon, Official Delegate from the Government of Kiautschou: (1) "Stadtanlage und sanitäre Einrichtungen in Tsingtau" ("Town Planning and Sanitary Conveniences at Tsingtau"); and will introduce a discussion on (2) "Die Notwendigkeit der Quarantänebestimmungen an den Küstenplätzen Ostasiens nach Möglichkeit in Uebereinstimmung zu bringen"

("The Necessity for Uniform Quarantine Regulations for all the Coast Ports of China").

Captain Edward B. Vedder, M.D., United States Army Medical Corps, Manila: "An Experimental Study of the Action of Ipecacuanha on Amœbæ."

G. Duncan Whyte, M.B., Swatow: "Tuberculosis in South China."

J. P. A. Wilson, F.R.C.S., Ed., D.P.H., Official Delegate from the Government of Johore: Subject not yet announced.

## Drugs and Appliances.

At the recent International Hygienic Exhibition, held at Dresden, a Grand Prix was awarded to Messrs. A. Wulfing and Company in the Pharmaceutical Section for their preparations of Sanatogen, Formamint, and Albulactin.

Apollinaris Water also received a Grand Prix at the same Exhibition.

## Recent and Current Literature.

*A list of recent publications and articles bearing on tropical diseases is given below. To readers interested in any branch of tropical literature mentioned in these lists the Editors of the* Journal of Tropical Medicine and Hygiene *will be pleased, when possible, to send, on application, the medical journals in which the articles appear.*

### "Report of the Department of Sanitation of the Isthmian Canal Commission for the Month of August, 1911."

Gorgas, reporting on the health of the employees of the Isthmian Canal Commission for the month of August, 1911, states that the total number of deaths was thirty-eight: twenty-six from disease, twelve from violence. Amongst these there were four deaths from blackwater fever, and one from malignant malaria. Nineteen cases of diphtheria were reported: fourteen from the Canal Zone, three from Panama, and two from Colon—with one death. The type of the disease was mild. No cases of yellow fever, small-pox, or plague originated on or were brought to the Isthmus during the month.

### "American Journal of the American Sciences," September, 1911.

*Trichina spiralis.*—Lamb, investigating four cases of trichinosis in the human subject, found the embryo of the trichina in the peripheral blood of two of the cases. This is not, of course, a new discovery, others having found the same thing before. For the detection of the embryos he used Staübli's original method. As regards blood counts the eosinophiles were increased, and this phenomenon would appear to be of great value in the diagnosis of the condition.

### "Lancet," October, 1911.

*Chyluria.*—Charteris, of Glasgow, reports a case of chyluria in a patient in Glasgow. In early life the patient had been a sailor and had visited Egypt, India, Brazil, America and the East. It is exceedingly likely that he became infected with *Filaria bancrofti* then. Since 1880 he had never left Scotland. In 1900, after repeated ague-like attacks chyluria appeared. During treatment Dr. Charteris found that the presence of the chyle in the urine was markedly affected by the position of the patient. For example when he was upright the urine was practically free from fat, but if he reclined at an angle greater than 45° he promptly began to pass milky urine. The most milky urine was passed when he lay flat on his back, but on the other hand, if he lay on his face the urine remained clear. Charteris believes that the condition was brought about by some intermittent pressure exerted on the thoracic duct which only became operative when the patient assumed certain attitudes. He suggests that the obstruction was probably due to a pedunculated calcareous gland. Though Charteris is inclined to class this case as one of a non-parasitic nature, the history and symptoms exhibited tend to show that it is only a case of filarial chyluria.

### "The Boston Medical and Surgical Journal," October 19, 1911.

*Malaria and Cerebrospinal Fever.*—Collins, of Northampto , Mass., reports a case of cerebrospinal fever co-existing with benign tertian malaria. The coexistence is not a common one, but there is no reason why it should not occur. The condition was identified and accurately determined at autopsy. One point of interest was that the patient seemed to have brought the *Diplococcus meningitidis* with him to America from Greece, whence he had emigrated.

### "Lancet," October 21, 1911.

*Beri-beri.*—Fraser writes on the "Relation of the Organic Phosphorus Content of various Diets to Diseases of Nutrition, particularly beri-beri." This is a letter dealing at some length with some of the errors which the author believes Schaumann has fallen into, especially with the latter statement that tropical beri-beri is due to deficiency of organic phosphorus compounds in the diet. The present problem, Dr. Fraser states, is one for solution by physiological chemists who will require to isolate and identify the substance contained in the subpericarpal layers, the absence of which in a diet causes the symptoms of beri-beri.

### "Lancet," November 4, 1911.

*Leishmania.*—Franchini, in the above number of the *Lancet*, states that the parasite of Kala-Agar (*Leishmania donovani*) can live and develop in the intestinal tract of anopheles. The mosquito used for the experiments was the *Anopheles maculipennis*. These were fed on cultures, and, after varying periods of time, smears were made from their stomach contents and stained by Giemsa's method. In these the flagellate form of the parasite was seen. Negative results were got with bugs, fleas, and lice. The author seems to have forgotten, or not to have heard of, Patton's work in India on the development of *Leishmania donovani* in bugs. Whether this phenomenon in the stomach of the bug, and now in that of the mosquito, means anything is by no means certain.

## Notices to Correspondents.

1.—Manuscripts sent in cannot be returned.

2.—As our contributors are for the most part resident abroad, proofs will not be submitted to those dwelling outside the United Kingdom, unless specially desired and arranged for.

3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.

4.—Authors desiring reprints of their communications to the Journal of Tropical Medicine and Hygiene should communicate with the Publishers.

5.—Correspondents should look for replies under the heading "Answers to Correspondents."

## Original Communication.

# THE ETIOLOGY OF BERI-BERI.*

By HENRY FRASER, M.D.(Aberd.),

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AND

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(*Continued from p.* 341.)

### FEEDING EXPERIMENTS ON ANIMALS.

IT was designed in the first instance to carry out experiments with anthropoids, which we considered were more likely to yield information of value than experiments with animals lower in the zoological scale. Though anthropoids of several species are comparatively common in this country, it was not without considerable difficulty that we were enabled to secure a sufficient number of them to make the experiment. Finally six were obtained. These were confined in separate cages, and received cooked white rice and water. The results were unsatisfactory, as shortly after the beginning of the experiment several of the animals refused to eat the rice, and all of them died of dysentery.

Six monkeys were fed in a similar manner. All of them became very much emaciated, and five died after three months, apparently of inanition. No degenerative changes were found in the nerves.

These experiments having therefore ended in failure, recourse was had to experimentation with fowls, which previous observers had shown to be readily susceptible to a form of polyneuritis following the ingestion of certain foodstuffs.

Eijkman [12] was the first to observe among fowls kept at the Government laboratory at Weltevreden, Java, spontaneous polyneuritis characterized by degeneration of peripheral nerves and atrophy of the ganglion cells in the anterior cornua of the spinal cord. This condition he attributed to feeding with cooked rice. Experimentally he could produce the disease with decorticated, cooked, and raw rice, but could prevent it by the addition of the fine inner capsules of the rice grain, the so-called silver layer (Zilvervliesjes), and could also cure it in the same way. By the administration of different forms of pure starch a similar disease was produced; potato starch was the only one that proved to be harmless. Eijkman was of opinion that a toxic substance in rice and the other varieties of starch developed in the crops of the fowls.

He adds that his investigations show that an apparently physiologically perfect diet can produce severe disease conditions and lead to death.

Eijkman repeated his experiments in Holland, and found that the changes in the peripheral nerves were the most important features found on *post-mortem* examination. They concerned the sensory as well as the motor fibres. They involve bundles of the nerve trunks, and present the picture of a non-inflammatory atrophic degeneration, such as is seen when a nerve is cut off from its trophic centre. Certain changes in the posterior nerve roots also occur; these likewise show the characters of degeneration and atrophy. The muscles innervated by the affected nerves when treated with osmic acid show a large number of fine fat globules. Feeding with decorticated rice, raw or cooked, and immaterial of the origin or quality of the padi, produced the disease in three or four weeks.

In later investigations Eijkman fed fowls with ground rice and water rolled into balls, and the animals developed polyneuritis. Also in fowls which died after three and a half months fed on husked barley he found many degenerated fibres in the sciatic nerve. If the fowls were fed on unhusked rice that had been heated in a sterilizer at 115° C. or 125° C. for two hours, the animals developed polyneuritis—after twenty-three days in the case of rice heated to 115° C., and after twenty-one days in the case of rice heated to 125° C. Simple boiling did not destroy the protective value of unhusked rice. Sterilized barley as well as rye and millet acted in the same way as rice.

Grijns [13], continuing the work of Eijkman, found that by adding a certain quantity of Katjang idju (*Phascolus radiatus*) to a diet of peeled rice the onset of polyneuritis in fowls was prevented.

Hulshoff Pol [14], pursuing the line of research suggested by the experiments of Grijns, has shown that Katjang idju has prophylactic and remedial properties in beri-beri. He has further shown that a decoction from a moderately large quantity of Katjang idju possesses the same prophylactic and curative properties as the Katjang idju itself. Dr. Pol considers that an acid ("X" acid) separated from the decoction is the active principle, but owing to difficulties in the way of the preparation of this substance no experiments have yet been made with it.

Kiewit de Jonge [15] has also tested the value of Katjang idju as a prophylactic and therapeutic remedy in beri-beri. He carried out an admirably planned and extensive investigation in the Lunatic Asylum at Buitenzorg, and fully confirms the work of Grijns and Pol. The very valuable work of the Dutch school will be referred to later in conjunction with the results that have emerged from our own work.

In view of the results already attained by the Dutch physicians, it was considered probable fowls would serve our purposes, and a preliminary experiment was made by feeding fowls on white rice which was known to have been associated with an outbreak of beri-beri. A control group was fed on parboiled rice.

* Studies from the Institute for Medical Research, Federated Malay States. No. 12. Singapore: Kelly and Walsh, Ltd., Printers, and at Shanghai, Hong Kong, and Yokohama. 1911.

The fowls were confined in separate cages, and were in all respects under identical conditions. The cages, which were open at the bottom, rested on a hard layer of clay, the surface of which was covered with sand, and though the possibility of the fowls obtaining such things as worms and the like was not excluded, the conditions were more natural than if the cages had rested on a wooden or concrete floor.

In addition to rice, which was supplied twice daily at 10 a.m. and 3 p.m., a small tin filled with water was placed in each compartment. The original weight of each fowl was noted, and thereafter they were weighed once weekly at 12 noon.

In the group of fowls on white rice (Experiment No. 1) the first sign of disease was noted in a fowl on the twenty-sixth day of the experiment. In the morning it was observed that there was weakness of the leg muscles and consequent uncertainty of gait. When stimulated, it would move about in an uncertain way. Examination of the blood failed to reveal the presence of any parasite or other abnormality.

Two days later the paralysis had advanced very considerably. It was quite unable to walk, and the wing muscles were also involved, so that these drooped. The diet was now changed to parboiled rice and padi, but it was unable to eat, and on the ninth day of the illness the fowl died. On *post-mortem* examination no macroscopic change was noted; there was no effusion into the serous cavities and no marked dilatation of the heart. The principal nerves of the legs and wings were preserved, and on subsequent examination showed characteristic Wallerian degeneration.

To test the possibility of the disease being a communicable one and unconnected with the diet, a fowl (No. 1 of the parboiled rice group) was transferred to the cage occupied by the fowl suffering from polyneuritis on the fifth day of the disease. This fowl was continued on parboiled rice as heretofore, and remained healthy at the conclusion of the experiment five weeks later.

A fowl developed the disease on the twenty-eighth day of the experiment. At 10 a.m. it was noticed to be unsteady, but was able to walk about. Two hours later paralysis had extended greatly, and the fowl rolled about in the cage in an endeavour to recover the upright position. The head was markedly retracted, and when extended immediately returned to this position. The wings were drooping. An attempt was made to feed the fowl with padi, but it was unable to eat owing apparently to the spasm of the neck muscles. On the following day the animal died.

This type of case, which was of the convulsive form of polyneuritis of fowls, was not infrequently observed throughout the experiments. It was less common, however, than the type in which simple paralysis was the principal feature.

On the day of onset of the disease a fowl was transferred from the parboiled rice group and placed in the cage to test the possibility of infection. The result in this, as in numerous subsequent tests, entirely negatived the possibility of the disease being communicable by contact or through intermediate hosts as ticks or lice.

Within eight weeks eight of the twelve fowls had developed polyneuritis. Though the experiment was continued for four weeks longer, the other four fowls remained healthy.

The group of fowls on parboiled rice (Experiment No. 2) originally numbered eight. This number was afterwards increased, as fowls from this group were transferred to cages occupied by fowls suffering from polyneuritis. In all twelve fowls were under observation for periods varying from five weeks to thirteen weeks. At the conclusion of the experiment all remained healthy.

It was thus shown that fowls were sensitive to differences between these two kinds of rice, and the occurrence of polyneuritis furnished a reaction which has proved of the utmost value.

In this, as in subsequent experiments, every possible effort was made to transmit the disease to the fowls of the control groups, but with uniformly negative results.

The previous researches had shown conclusively that white rice was either the vehicle by which the agent producing beri-beri was introduced into the body, or that white rice was deficient in some substance or substances essential for metabolism. Parboiled rice neither conveyed this disease-producing agent, nor was it deficient in the substance or substances essential for metabolism.

By following up the results of these initial experiments on fowls, we thought that it might be possible to determine the factors of importance in the etiology of beri-beri. In the case of poisons it should be possible to remove them from white rice and render it innocuous; if it were a deficiency, it should be possible to supplement that deficiency either by the addition of the substances removed in the process of polishing, or by the addition of substances extracted from parboiled or unpolished rice.

## The Poison Hypothesis.

The chemical experiments already referred to had not been successful in isolating a poison recognizable by chemical means, and the inoculation experiments performed on guinea-pigs, rabbits, and monkeys, with various substances isolated from white rice, yielded no satisfactory result.

The disease which occurs among fowls fed on white rice provided a means of carrying out further experiments on the poison hypothesis. The existence of a poison or poisons in white rice had not at this time been definitely excluded, and the further possibility remained that the harmful substance or substances could not be detected by any of the chemical reactions employed. Experiments were therefore undertaken with products extracted from white rices. In the first of these (Experiment No. 3) white rice obtained from the supplies issued

during the inquiry at Durien Tipus was used. The rice was treated in the following manner:—

(1) 1.5 kilogrammes of finely ground rice was macerated for four days in 1.5 litres of 94 per cent. alcohol.

(2) The mass was then transferred to a percolator and percolated with the alcohol in which it had been macerated.

(3) The mass was further percolated with 0.5 litre of 94 per cent. alcohol. This operation was repeated three times.

(4) After percolation was complete the rice was removed, freed from alcohol by expression, and dried in the sun.

Five fowls were fed on the exhausted rice, and three developed polyneuritis within five weeks.

It appeared therefore that percolation with cold alcohol had failed to dissolve out the hypothetical poison.

In the second experiment (Experiment No. 4), rice from the same source was extracted with hot alcohol in the following manner:—

(1) 1.5 kilogrammes of coarsely ground rice had poured over it 1.5 litres boiling 90 per cent. alcohol. It was allowed to macerate for several days.

(2) The mass was then transferred to an apparatus for extraction with hot alcohol. This was an enlarged form of Soxhlet apparatus made of copper. The rice was treated in this apparatus by extraction with alcohol for twelve hours.

(3) 300 c.c. alcohol were added on two occasions, the further extraction being continued for eight hours.

(4) The alcohol was expressed and the rice dried in the sun.

Four fowls were fed on the exhausted rice, and two developed polyneuritis. Percolation with hot alcohol had also failed to dissolve out the hypothetical poison.

The bulk of the extracts from the rices had been employed in the chemical experiments, but a quantity of the extract prepared by means of hot alcohol remained. This alcoholic extract had most of the alcohol removed from it by distillation *in vacuo*, and was finally freed from alcohol by exposure in shallow basins at a low temperature. The alcohol-free extract was emulsified in distilled water, and two fowls (Experiment No. 5) fed on parboiled rice received in addition daily an emulsion of the extract representing that obtained from 100 grm. of white rice. The experiment was continued for fifty-one days. Both fowls gained in weight and showed no signs of any disease.

These experiments showed that no alcohol-soluble poison was contained in white rice.

In order to control the results of experiments with products obtained by extracting white rices with alcohol, parboiled rices were treated by precisely similar methods to those already described.

In the first of these experiments (Experiment No. 6) the product employed was obtained by treating parboiled rice with hot alcohol in an extraction apparatus of copper, the copper Soxhlet apparatus already described. This proved to be an unsatisfactory method for the extraction of parboiled rice and a special extraction apparatus was thereafter employed.

The technique employed in the extraction of rice by this method was as follows:—

(1) One kilogramme of rice was ground to a coarse powder and placed in a cylindrical jar. One litre of hot alcohol was poured over the rice and the mixture stirred daily for several days.

(2) The mixture was transferred to a flask of 2,250 c.c. capacity and connected up with the extraction apparatus.

(3) After heating for one hour the liquid was aspirated off.

(4) Half a litre of alcohol was added to the partially exhausted rice, the mixture heated as before and the liquid aspirated off. This process was repeated four times.

The exhausted rice was freed from alcohol by exposure to the sun.

The alcoholic extracts, by whichever apparatus obtained, contained a quantity of insoluble matter, due to the coarseness of the method by which separation of the menstruum from the marc was effected. No attempt was made to separate the soluble and insoluble substances from these extracts by further filtration, and it is possible that the presence of insoluble substances in the liquid may explain the equivocal results obtained in the extraction of parboiled rice with 94 per cent. alcohol.

In Experiment No. 6 parboiled rice which had been ground and afterwards exhausted several times with hot 94 per cent. alcohol was used. It was anticipated that by this method such substances as lecithin and a portion of other fats would be removed from it. Four fowls only were employed for the experiment. In the fifth week one of them developed a condition indistinguishable clinically from other cases of polyneuritis in fowls fed on white polished rice.

This result indicated that some protective substance ordinarily present in parboiled rice had been removed by treatment with hot 94 per cent. alcohol, and further experiments were undertaken to test the value of this suggestion.

In the experiments next to be described alcohol of 94 per cent. strength was employed. For the products employed in Experiments Nos. 7 and 8 the special extraction apparatus was employed. The positive pressure generated by the boiling fluids within the flask was employed for withdrawing the liquid. The compact character of the rice mass made it difficult to secure more than very coarse filtration of the solution. Of twelve fowls fed on the exhausted rice in Experiment No. 7 two developed polyneuritis within five weeks and two more in the sixth week. Fowls fed on white rice to which was added the extract from 83 grm. of unpolished parboiled rice daily (Experiment No. 8) all remained healthy.

It was concluded from these experiments that

the protective substances were soluble in hot alcohol of 94 per cent. strength.

A further experiment (No. 9) was carried out with unpolished parboiled rice extracted with 94 per cent. alcohol in the special extraction apparatus. One fowl died in the seventh week. No cases of polyneuritis occurred.

In the control experiment (No. 10) in which the extracted substances were added to a white rice diet, all the fowls remained healthy.

These latter results can only be explained by assuming that the essential substances were only partially extracted from the unpolished parboiled rice.

The next experiment (No. 11) was one in which parboiled rice from the same sample as used in Experiment No. 6 was treated with cold alcohol of 94 per cent. strength by maceration and percolation. At first five fowls only were employed in this group, but as cases of polyneuritis occurred in fowls fed on white rice treated by identical methods, fowls were transferred to the latter group and continued on the same food to test the possibility of conveying infection. To replace these, fowls were added, and in the course of the experiment eight fowls in all were under observation.

While some of the fowls lost weight the general result was a gain in weight, and all remained healthy at the conclusion of the experiment.

It would appear that cold 94 per cent. alcohol is not an effective solvent of the protective substances.

In Experiments Nos. 12 and 13 unpolished parboiled rice was extracted with alcohol of proof spirit strength in the extraction apparatus. The extracts freed from alcohol in the manner already described were used in these experiments.

In Experiment No. 12 twelve fowls were fed on the exhausted rice; three developed polyneuritis within five weeks. In the corresponding experiment (No. 13) in which the alcohol-free extract obtained from 60 grm. of unpolished parboiled rice was added daily to the diet of twelve fowls on white polished rice, all the fowls remained healthy for five weeks.

This result shows that the essential protective substances are also soluble in alcohol of proof spirit strength.

In the foregoing series of experiments, which were of a tentative nature, no evidence was obtained that white (polished) rice ever contained a beri-beri producing agent. The results taken in conjunction with the histological findings suggested that by the removal of the subpericarpal layers of the grain in the process of milling, the grain is deprived of some substance or substances of high physiological value.

In subsequent experiments this conclusion was abundantly confirmed. In giving a detailed record of the experiments, therefore, these are arranged in accordance with the conclusions ultimately arrived at and not in chronological order. It is hoped that in this way the position will be made clearer.

### Experiments with various White Rices.

Experiments were carried out with white polished rices from various sources. These may properly be grouped in a single series.

In the first experiment of the series (Experiment No. 14) the white polished rice used in the inquiry at Durian Tipus was employed. Of the four fowls used for the experiment three developed polyneuritis within four weeks.

The second experiment of the series (Experiment No. 15) was one designed to test the effect of feeding fowls on a white polished rice, while at the same time another group (Experiment No. 25) was fed on the original partially husked padi from which this white rice had been prepared, and yet another (Experiment No. 32) on the white polished rice to which the substances removed in the polishing process had been added. In the group under review, those to which white rice alone was given, one fowl died on the third week without signs of polyneuritis—six others developed polyneuritis within five weeks.

The third experiment of the series (Experiment No. 16) was carried out to test whether, as alleged by Braddon, rice that had become stale on account of changes occurring in it in the interval between milling and consumption was more harmful in its influence than freshly milled rice. An assistant was stationed in Singapore who forwarded to the laboratory daily by the most expeditious route a quantity of white polished rice milled on the day of despatch. Of twelve fowls fed on this rice five developed typical polyneuritis within four weeks, a result similar to that in experiments in which white polished rice varying in age from a few months to two years was employed.

Experiments Nos. 17 and 18 were carried out with white polished rice of the best quality (No. 1 Siam) purchased locally. In one of them nine fowls out of twelve developed polyneuritis within nine weeks, seven cases occurring before the end of the fifth week. In the other, eleven cases among twelve fowls occurred within five weeks. It appeared in these experiments that certain fowls were more resistant than others to the injurious influence of white rice. The reason for this was not ascertained, though the observation was made that such fowls were commonly the younger members of the group, while those who succumbed most quickly were the full-grown fowls who consumed a large quantity of rice. It was also noted that after two or three weeks fowls on white rice usually showed a disinclination to eat.

These observations which are similar to those made when human beings were under observation, appear to us to be irreconcilable with the idea of simple deprivation of proteins, fats or carbohydrates being the final explanation of the occurrence of the disease.

Experiment No. 19 was carried out with a white polished rice as a control to other experiments in which this same sample was employed as the

principal article of diet, various materials being added to it. Experiment No. 20 was carried out for a similar purpose.

In every case of polyneuritis Wallerian degeneration was demonstrated microscopically in the affected nerves. The changes are apparently identical in every way with those found in the peripheral nerves in beri-beri. An extensive investigation of all the materials obtained is now being carried out by Dr. Fletcher.

*Rangoon Rice.*

There is evidence that the variety of white polished rice known as Rangoon rice is less harmful than Siam Rice. Braddon quotes examples in support of this view and instances have fallen under our own observation.

In Experiment No. 21 twelve fowls were fed on Rangoon rice. Two fowls died in the fourth and fifth weeks respectively, but there was no clinical or pathological evidence that they suffered from polyneuritis. Both had a form of purulent conjunctivitis.

A typical case of polyneuritis was observed in the fifth week, and no other case occurred until the fifteenth week, when another two fowls suffered from it. All three cases resulted fatally and the diagnosis was confirmed *post mortem*.

Such evidence as is furnished by this single experiment confirms the experience of those who assert the comparative harmlessness of Rangoon rice.

The explanation of this observation is a matter for further inquiry. Whether the padi grown in Burmah is richer in protective substances and therefore can afford to lose in the polishing process a greater quantity of them without harmful result, or whether there is some important difference in the milling process it is impossible yet to say. From histological examination of the grains we incline to the former view.

STARVATION AND FORCED FEEDING EXPERIMENTS.

As has been already stated it was usually found that after the first few weeks on a white rice diet, most fowls showed a disinclination to eat. Commonly also fowls lost greatly in weight before the development of polyneuritis. That these were by no means constant features, however, is shown by the fact that in some cases fowls continued to eat well and maintain their normal weight until the disease declared itself.

Despite the fact that groups of fowls on a diet of padi unpolished rice or parboiled rice usually continued to eat well throughout, the suggestion was raised that on account of the monotonous nature of a diet of white rice the fowls ceased to eat, and that polyneuritis was a result of partial simple starvation. This was at all events a point that required to be tested, and accordingly experiments were carried out.

In the first experiment of this series (Experiment No. 22) four fowls hitherto feeding on padi were employed. Nothing but water was supplied. The bottom of the cage being open they had access to such food, insects and the like, as could be obtained there—this condition of affairs was, however, controlled by the fact that all fowls, including those on white rice, were similarly circumstanced. Within four weeks all the fowls had lost greatly in weight and were weak, but none of the signs constantly associated with polyneuritis had shown themselves. Within a similar period some fowls of a group fed on white polished rice had invariably shown signs of polyneuritis.

The number of fowls in the first experiment was, of course, too small to furnish any definite information, and a second experiment with twelve fowls was begun (Experiment No. 23). Within five weeks two of the fowls composing this group had died, and two others were killed when their condition was such that it was apparent they would die within a few hours. None had showed any clinical signs of polyneuritis, and careful examination of the nerves showed no characteristic degeneration changes.

A third experiment (No. 24) was carried out with a similar result.

It was concluded that polyneuritis of fowls is not due to general deprivation of food, but to deprivation of some particular element in a diet of white polished rice.

In order to test further the correctness of this conclusion Dr. Fletcher carried out an experiment in which two groups of fowls were fed on white rice (Experiment No. 25).

To the first group of six fowls 30 grm. of white rice was supplied twice daily in the ordinary way. To the second group of six fowls 30 grm. of white rice was passed into the crop twice daily.

The result showed that there was no difference between the two groups as to their liability to develop polyneuritis. Polyneuritis, therefore, cannot be due to simple deprivation of food.

An interesting observation made by Dr. Fletcher in connection with this experiment was that when a fowl which was being forcibly fed suffered from the disease the normal digestive powers were markedly interfered with and the crop remained constantly distended with rice. If, now, a small quantity of polishings was passed into the crop the accumulated rice seemed to be dissolved and normal digestive power was speedily regained.

EXPERIMENT WITH UNPOLISHED RICES.

During the course of the experiments it was observed that fowls always remained in health on padi, and fowls suffering from polyneuritis almost invariably recovered when given padi. The present experiment was one in which a partially husked rice, known commercially as "cargo rice," was employed—about half the grains are denuded of husk. This experiment was carried out as a preliminary to certain experiments in which this same

product, after milling in various ways, was employed. These latter experiments will be referred to later.

In the experiment now under review (Experiment No. 26), twelve fowls were fed on partially husked rice for six weeks and all remained in good health at the conclusion of the experiment.

Other experiments in which padi and unpolished rices were employed are detailed elsewhere—all these experiments confirmed the observation that fowls remained in health when fed on rice which still retained its subpericarpal layers.

*Experiments with Parboiled Rice.*

Experiments with parboiled rice were carried out simultaneously with and for longer periods than experiments with white polished rice, as controls for the results obtained in the latter groups.

The experiment first described, No. 27, was one undertaken at the beginning of the series. In it five fowls only were employed. All maintained health and weight during fifteen weeks, cooked unpolished parboiled rice only being supplied throughout. It was thus shown that, in the conditions under which our experiments were carried out, a diet of parboiled rice and water was sufficient to maintain fowls in health and weight over prolonged periods, and this result repeatedly obtained was regarded as an adequate control to results obtained in shorter periods, five weeks or less.

In Experiment No. 28 that form of parboiled rice known as "muthu samba," which is prepared in India, was employed. It is an expensive variety, and is eaten only by the more wealthy members of the Indian community. Many fowls in this group showed a moderate gain in weight at the end of six weeks, a few showed a slight loss, all remained healthy throughout.

The next experiment of this series (No. 29) was used as a control to the results obtained in another group of fowls fed on the same sample of rice after exhaustion with proof spirit (in the latter group four cases of polyneuritis occurred within six weeks). In the experiment now under discussion, which was continued for ten weeks, though most of the fowls lost materially in weight and one died in the ninth week, none showed recognizable signs of polyneuritis.

In Experiment No. 30 parboiled rice in a finely ground state was used as a control to the results in groups in which a similar product after exhaustion with alcohol was employed.

It is apparent from the results of this series of experiments that marked differences exist in the nutritive value of different samples of parboiled rice. These differences are due to two factors, the initial richness of the grain, and the extent to which the polishing process has been carried out. It does not appear that the method of treatment by parboiling before husking operates in any way other than to harden the external layers of the grain, rendering them less easy of removal.

*Experiments with Malay Rice.*

It is conceded by all those whose knowledge of this country and of its people enable them to speak with authority upon the point that among Malays under primitive conditions beri-beri is very rare.

Braddon states that "among these natives so long as they lead their primitive pastoral and agricultural life untouched by the influences which march with a civilization represented by encroaching hordes of Chinese beri-beri never occurs."

Hamilton Wright [16] says: "My own experience of Malay Kampongs (Malay villages) is that beri-beri is almost unknown in them. The farther the Malay population is removed from centres of civilization the less beri-beri is seen in it."

Daniels [17] says: "Malays living in Kampongs are the only class that do not suffer from beri-beri."

An account has already been given of the Malay method of preparing rice.

The first experiment in this series (Experiment No. 31) was one in which a rice prepared from a locally grown padi was employed. This was obtained from the Kuala Pilah district through the kindness of the District Officer, Mr. Eric Dickson, and Dr. Lucy.

A Malay woman prepared rice from this padi after the manner and with the primitive implements used by Malays in their own villages.

Of the twelve fowls employed for this experiment all remained healthy with the exception of one which on the forty-second day of the experiment developed polyneuritis. The attack ran the usual course, and on emulsion of rice polishings and padi the fowl recovered completely in six weeks.

In the second experiment in this series (Experiment No. 32), which was one of a group of experiments to which particular attention will be directed later, Malay rice was prepared from a partially husked padi imported from Indo-China.

The method of preparation of this rice was similar to that employed in Experiment No. 31.

As the supply of this product was limited only eight fowls were employed for this experiment and it lasted only five weeks. All the fowls remained normal throughout this period.

The occurrence of a case of polyneuritis in a fowl fed on "Malay" rice calls for some comment. It is the single instance throughout these experiments in which hundreds of fowls have been employed, in which polyneuritis developed in a fowl on a diet other than white polished rice. The clinical appearances were in all respects identical with those of other cases of polyneuritis, and we do not assign to the case an origin other than dietary. It appears that even the limited amount of polishing to which Malay rice is subjected in its preparation may on occasion be harmful.

EXPERIMENTS WITH POLISHINGS.

As it now appeared that the harmfulness of a rice diet varied directly as the extent to which the rice had been milled, it was determined to test this

hypothesis further by adding to a white polished rice, which when given alone had been shown to be harmful, a quantity of polishings equal in amount to that which had been milled away. The miller estimates that from 40 parts of padi there are produced 25 parts of rice and 5 parts of polishings; 16 per cent. of the husked grain is thus lost in polishing. An actual weighing of some thousands of grains of unpolished and polished rice from the same lot of padi showed that the loss was about 10 per cent.

In the first experiment of this series (Experiment No. 33) the white polished rice selected was the same sample as that employed in Experiment No. 15, and which when fed alone had resulted in six cases of polyneuritis among twelve fowls in five weeks.

The rice polishings were from the same sample. They were sifted in order to remove husks and broken rice and given in the form of an emulsion with distilled water.

During the first and second weeks of the experiment an amount of emulsion equal to 10 grm. of polishings was given daily for a fowl eating 60 grm. of rice.

During the third week 8 grm. of polishings were given daily, during the fourth and fifth weeks 6 grm., during the sixth week 4 grm., and during the seventh week 3 grm. were given.

Up to the seventh week all the fowls gained slightly in weight. In the seventh week there was a moderate loss amounting to 2.6 grm. per kilogramme of body weight.

In the seventh week there was a moderate loss, 2.6 grm. per kilo. It was concluded, therefore, that the amount of polishings necessary to add to 60 grm. of this sample of white polished rice to maintain the normal nutritive equilibrium was between 3 and 4 grm., say 3.5 grm. This amount being added, there was in the eighth week a slight gain in weight in the whole group.

It was considered desirable to repeat this result with a rice from a beri-beri outbreak. An experiment was therefore planned in which eight fowls were fed on the Durian Tipus rice, each alternative fowl receiving in addition an amount of polishings equal to 3.5 grm. per kilo of body weight.

The result is as shown by the Experiment No. 34. In four weeks two of the fowls fed on rice alone had developed polyneuritis, and all four had lost weight, while the four fowls which were given polishings in addition remained healthy and at the conclusion of the experiment all had gained in weight.

The conclusion was now arrived at that certain essential substances are lacking in the case of white polished rice, and that the addition of rice polishings to a diet of white polished rice prevents the occurrence of polyneuritis in fowls.

### The Phosphorus Content of Rice as an Indicator of the Extent to which Rice has been Polished.

Having proved that the occurrence of polyneuritis in fowls, and of beri-beri in man, is due to the consumption of rice from which the subpericarpal layers have been removed by the process of polishing, that such rice is equally harmful whether freshly prepared or stored for months, the development in it of a poison is excluded and it is necessary to revert to the consideration of the results obtained from analyses of rices.

In the tables the results of these analyses are given, both for the undried and dried materials. The table showing the results calculated on the dried materials facilitates comparison.

Comparing the diet of unpolished rice with that of polished rice, it will be seen that there are considerable differences. A diet of polished rice made up with polishings to the necessary amount for the maintenance of weight and health approximates in composition to one of unpolished rice, and it might therefore be inferred that the deficiency of white rice in respect of proteins, fats and salts was accountable for its harmful results. The protein content of polished rice differs only by a slight amount from that of two parboiled rices which were proved harmless, and, allowing for experimental errors, the differences are apparently insufficient to account for the results. In respect of fat the polished rice is poorer, but the difference is a small one and, as has been previously stated, can hardly account for the difference in the results. The ash gives a very imperfect representation of the salts present, but there is a considerable difference in the amount of ash present in the unpolished and polished rices, yet even the amount present in the latter rice exceeds that obtained from one of the parboiled rices.

Now in the case of parboiled rice extracted with hot alcohol (94 per cent.), the amount of fat removed is relatively great, but of proteins and ash relatively small and in the case of parboiled rice extracted with proof spirit similar results are observed.

The proteins were invariably estimated by the Kjeldahl process, and allowing for the possibilities of experimental error, it must be admitted that the differences in respect of proteins as determined by this method will not explain the results.

The question of the carbohydrates cannot seriously be considered, as these were calculated by difference.

These methods of analysis failed in every way to explain the results, and it was necessary to employ other methods. It was suggested to one of us by Dr. Mott that the deficiency of white rice in lipoids might be of importance, and various attempts were made to determine the amount of these present in rices, but the process was a tedious one, and the results not satisfactory. It was decided therefore to estimate the phosphorus pentoxide content of the various rices.

### Estimation of Phosphorus Pentoxide ($P_2O_5$).

Two methods were employed for the conversion of the phosphorus to inorganic combinations.

By the first process—

(1) A weighed quantity of the material was

burned in a platinum basin and the complete combustion of the organic matter was facilitated by sprinkling pure potassium nitrate over the ash.

(2) The residue was treated with 10 c.c. of strong hydrochloric acid and evaporated to dryness over a water bath.

(3) The residue was heated with 5 c.c. strong hydrochloric acid and 50 c.c. of distilled water for five minutes.

(4) Filtered and the filter-paper washed with hot water till the washings ceased to give a precipitate with silver nitrate and nitric acid.

(5) The combined filtrate and washings were evaporated to about 50 c.c.

By the second process:—

(1) A weighed quantity of the material was placed in a Kjeldahl flask and heated with concentrated sulphuric acid and potassium hydrogen sulphate until the fluid became colourless.

(2) The fluid was diluted with water and filtered. The filter-paper was washed with water until the washings ceased to give a precipitate with barium chloride.

(3) The combined filtrate and washings were evaporated to about 50 c.c.

(4) The concentrated filtrate and washings obtained either by the first process or the second process were neutralized with ammonium hydrate and a drop or two of nitric acid added to clear.

(5) To the solution 10 grm. of ammonium nitrate were added, the solution warmed to about 40° C. and excess of molybdic solution added.

(6) The mixture was kept in a warm place overnight and in the morning filtered. The precipitate was washed with a cold solution of ammonium nitrate (5 per cent.).

(7) The phospho-molybdate precipitate was dissolved in hot water and ammonium hydrate. It was so arranged that the filtrate and washings measured 100 c.c. or thereabouts.

(8) The solution of phospho-molybdate was neutralized with hydrochloric acid and excess of magnesia mixture added. After half an hour, 30 c.c. of ammonium hydrate (10 per cent.) were added.

(9) The mixture was allowed to stand overnight. In the morning it was filtered and the precipitate washed with ammonium hydrate (2.5 per cent.) till free from chloride.

(10) The precipitate was dried, ignited and the residue of magnesium pyrophosphate ($Mg_2P_2O_7$) weighed. From this weight the amount of phosphorus pentoxide was calculated by the use of the factor 0.6394.

By whichever method the conversion of the phosphorus into inorganic combination is effected the results obtained are the same, and it is entirely a matter of individual choice which shall be selected.

The gravimetric process was employed in preference to the volumetric because of its greater accuracy, and now that the facts have been determined there is no reason why the volumetric process should not be employed.

Nearly two hundred estimations have been made and the results were invariably recorded on the undried material. The percentage of moisture in various kinds of rice does not vary greatly, being usually from 13—14 per cent., or thereabouts, and it was found that the percentage calculated on the dried material did not yield any information other than that obtained from the percentage calculated on the undried material.

Polished white rice of the kind commercially known as Siam rice yields on an average 0.26 per cent. of phosphorus pentoxide and is the variety usually associated with severe outbreaks of beri-beri. Schaumann gives an analysis of a rice yielding only 0.1 per cent. phosphorus pentoxide. This is lower than any result obtained here.

Polished white rice of the kind commercially known as Rangoon rice yields on an average 0.328 per cent. of phosphorus pentoxide and the incidence of beri-beri is less on this kind of rice than the former.

Malay rice yields on an average 0.38 per cent. of phosphorus pentoxide, and the incidence of beri-beri is still less on this kind of rice.

Parboiled rice yields on an average 0.415 per cent. or over of phosphorus pentoxide, and beri-beri does not occur when this kind of rice is eaten.

Unpolished rice yields on an average 0.54 per cent. of phosphorus pentoxide and can never produce beri-beri.

The great increase in the consumption of parboiled rice has induced the local millers to improve the appearance of their product, and this result some of them have sought to achieve by polishing, or as it is technically called, "pearling." Attention has previously been directed to the difficulty of accomplishing this on account of the toughening of the grain by soaking and steaming, but by the use of stone polishers it is possible to remove a considerable amount of the subpericarpal layers with consequent diminution of the phosphorus pentoxide content. We recently examined such a rice which only yielded 0.34 per cent. of phosphorus pentoxide (see Experiment 30).

Another sample of parboiled rice after hulling was examined and yielded 0.6 per cent. of phosphorus pentoxide. After pearling once it yielded 0.5 per cent., and after pearling twice it yielded 0.4 per cent.

An unpolished rice yielding 0.56 per cent. of phosphorus pentoxide was polished in the ordinary way, and the polished or white rice yielded only 0.26 per cent.

AVERAGE RESULTS OF ALL ESTIMATIONS.

| | Percentage of $P_2O_5$ |
|---|---|
| Polished Rice (Siam) ... ... | 0.26 |
| Polished Rice (Rangoon) ... ... | 0.328 |
| Malay Rice ... ... ... | 0.38 |
| Parboiled Rice ... ... ... | 0.415 |
| Unpolished Rice ... ... ... | 0.54 |

Fowls fed on polished rice and receiving

polishings in sufficient amount are receiving a dietary which approximates in its content of phosphorus pentoxide to a diet of unpolished rice. The harmfulness of rice is therefore in inverse proportion to its phosphorus pentoxide content and in direct proportion to the extent to which it has been polished.

None of the rices connected with outbreaks of beri-beri yielded more than 0.26 per cent. of phosphorus pentoxide. The rices substituted for these, and which were effective in preventing the continuance of the outbreaks yielded not less than 0.4 per cent. of that substance.

Attention should be directed to the percentage of the phosphorus pentoxide in parboiled rice after extraction with 94 per cent. alcohol, the diminution in amount is extremely small and apparently negatives the vital importance of this substance. In practice extracted rice would never be under consideration, and the value of this estimation as an indicator of the extent to which rice has been polished has stood the test of numerous experiments.

It will be contended that the estimation of any of the other constituents of rice would serve equally well for this purpose. It has already been shown that the estimation of proteins is not satisfactory. The removal of the total fats from a rice is an extremely tedious process, and the determination of total ash is complicated with errors of volatilization and incomplete ashing.

Admitting the value of those other estimations, it must still be conceded that the estimation of phosphorus pentoxide permits of a reasonable margin of error and furnishes differences which can be accurately determined and are more striking than would be furnished by any of the other constituents.

The results of numerous experiments had now made it clear that the addition of rice polishings to a diet of white polished rice prevented the harmful effects of such a diet. The further researches consisted in an endeavour to determine the nature of the substances in rice polishings which were responsible for this result.

In order that the results in the various experi-

ANALYSIS OF RICES.

| | | Protein | Fat | Carbo-hydrates | Ash | Moisture | Percentage of phosphorus pentoxide | Effect on fowls: estimated by the occurrence of polyneuritis |
|---|---|---|---|---|---|---|---|---|
| 1 | Polishings | 13.7 | 14.16 | 52.77 | 7.54 | 11.83 | 4.1 | |
| 2 | Unpolished rice | 9.0 | 1.65 | 75.52 | 1.08 | 12.75 | 0.56 | — |
| 3 | Polished rice | 8.6 | 0.22 | 76.23 | 0.6 | 14.35 | 0.26 | + |
| 4 | Polished rice (washed) | 8.2 | 0.22 | 75.04 | 0.34 | 16.2 | 0.21 | + |
| 5 | Polished rice (washed) plus polishings | 8.61 | 1.29 | 73.35 | 0.89 | 15.86 | 0.463 | — |
| 6 | Parboiled rice | 7.55 | 0.45 | 77.76 | 0.94 | 13.3 | 0.427 | — |
| 7 | The same rice after extraction with 94 per cent. alcohol | 7.6 | 0.06 | 80.66 | 0.88 | 10.8 | 0.425 | + |
| 8 | Parboiled rice | 7.8 | 0.5 | 76.62 | 0.78 | 14.3 | 0.41 | — |
| 9 | The same rice after extraction with proof spirit | 7.65 | 0.10 | 80.01 | 0.44 | 11.8 | 0.29 | + |
| 10 | Siam rice (Depot) | 7.8 | 0.15 | 77.49 | 0.56 | 14 | 0.28 | + |
| 1 | Siam rice (D. T.) | 7.45 | 0.17 | 78.02 | 0.51 | 13.85 | 0.28 | + |
| 2 | Rangoon rice | 7.3 | 0.63 | 77.15 | 0.74 | 14.18 | 0.33 | + |
| 3 | Indian rice | 6.3 | 0.2 | 78.31 | 0.84 | 14.35 | 0.345 | — |
| 4 | Malay rice from cargo rice | 7.7 | 0.23 | 75.43 | 1.14 | 15.5 | 0.52 | — |
| 5 | Malay rice from Malay padi | 7.2 | 0.63 | 77.29 | 0.88 | 14.0 | 0.37 | + |
| 6 | Siam rice No. 2 quality stale | 7.3 | 0.40 | 77.43 | 0.57 | 14.3 | 0.28 | + |
| 7 | Siam rice No. 2 quality freshly milled | 8.1 | 0.41 | 76.76 | 0.47 | 14.26 | 0.27 | + |
| 8 | Siam rice No. 1 quality | 6.9 | 0.20 | 77.26 | 0.40 | 15.24 | 0.22 | + |

ANALYSIS OF RICES (CALCULATIONS BASED ON DRIED MATERIALS).

| | | Protein | Fat | Carbo-hydrates | Ash | Percentage of phosphorus pentoxide | Effect on fowls: estimated by the occurrence of polyneuritis |
|---|---|---|---|---|---|---|---|
| 1a | Polishings | 15.5 | 16.0 | 60.0 | 8.5 | 4.6 | |
| 2a | Unpolished rice | 10.3 | 1.89 | 86.58 | 1.23 | 0.64 | — |
| 3a | Polished rice | 10.0 | 0.25 | 89.05 | 0.7 | 0.3 | + |
| 4a | Polished rice (washed) | 9.7 | 0.26 | 89.64 | 0.4 | 0.25 | + |
| 5a | Polished rice (washed) plus polishings | 10.2 | 1.53 | 87.22 | 1.05 | 0.55 | — |
| 6a | Parboiled rice | 8.7 | 0.51 | 89.79 | 1.0 | 0.492 | — |
| 7a | The same rice after extraction with 94 per cent. alcohol | 8.5 | 0.06 | 90.46 | 0.98 | 0.476 | + |
| 8a | Parboiled rice | 9.1 | 0.58 | 89.76 | 0.56 | 0.47 | — |
| 9a | The same rice after extraction with proof spirit | 8.6 | 0.11 | 90.79 | 0.5 | 0.32 | + |

ments of the series should be comparable it was considered desirable that the various rices and rice products employed should be derived from the same lot of padi. Accordingly we obtained from a rice mill in Singapore the materials desired:—

(1) A quantity of the rice as it passed from the huller to the polishing machines. At this stage the grain is deprived of the husk only (unpolished rice).

(2) A quantity of the rice, after having passed through the polishing machines (white polished rice).

(3) A quantity of the rice polishings or rice meal collected from the polishing machines.

A preliminary series of experiments was carried out to test the value of these various foodstuffs when fed to fowls.

In Experiment No. 35 the unpolished rice was employed. It was shown that this foodstuff, in addition to which only water was supplied, sufficed to maintain fowls in good health for many weeks.

In Experiment No. 36 the white polished rice was employed. Within three weeks six fowls out of a total of twelve fowls included in the experiment suffered from polyneuritis.

In Experiment No. 37 the white polished rice diet identical with that in Experiment No. 36 was employed. In addition each fowl received daily 5 grm. of sifted rice polishings emulsified in water. All the fowls remained healthy.

This series of experiments confirmed results previously obtained and showed that these materials were suitable for employment in the further researches which it was proposed to undertake.

As an instance of the practical application of these principles, Dr. J. M. Atkinson, Principal Civil Medical Officer, Hongkong, permits us to refer to some notes he has made in regard to the medical history of the Victoria Gaol, Hong Kong. At the meeting of the Far Eastern Association of Tropical Medicine at Manila in March, 1909, we communicated the results of our observations in regard to the causation of beri-beri and advanced the view that the use of unpolished rice would be found an effective preventive measure. Dr. Atkinson, who was the official representative of Hong Kong at the meeting, on his return to the Colony, made inquiries as to the diets in the various public institutions. He found that in the Victoria Gaol, which had been singularly free from beri-beri, unpolished rice had been in use for many years. The average daily number of prisoners in this gaol is over 500, many of them being long-sentence prisoners.

The Chief Superintendent of Police reported the facts as follows:—

"No case of beri-beri has originated in the gaol in the last fifteen years. Polished rice is not supplied to the prisoners and never has been. They have always been given unpolished rice, as it is cheaper than polished rice."

As beri-beri is one of the principal diseases afflicting the native population of Hong Kong, this observation is of great importance as showing the value of an unpolished rice diet in preventing beri-beri.

M. Breaudat and Dr. Denier, of the Pasteur Institute, Saigon, have recently published the report of an experiment, the results of which showed the value of rice polishings (*son*) as a preventive of human beri-beri.

(*To be continued.*)

**"Sleeping Sickness Bureau Bulletin," No. 30, 1911, vol. iii.**

The above number contains the following papers: (1) Development of *T. lewisi* in the Rat-flea; (2) Diagnosis; (3) The Rhodesian Trypanosome; (4) Chemotherapy; (5) Classification of Trypanosomes; (6) Tsetse-flies and their Bionomics; (7) Transmission of Surra; (8) Morphology; (9) Trypanosomiases of Animals, and other Papers; (10) Sleeping Sickness News: German East Africa, Cameroons, The Gold Coast and Togoland, French Congo; (11) Monthly List of References.

**"Lancet," November 4, 1911.**

*Beri-beri.*—Cooper and Funk write on the causation of beri-beri. They searched for the hypothetical substance in rice the removal of which is the cause of the disease. After confirming the results of Fraser and Stanton concerning the beneficial effects of the alcoholic extract of rice polishings, they precipitated a watery solution of the extract by means of phospho-tungstic acid, and found that the active substance is precipitated entirely by this reagent, and that the filtrate is completely inactive. Polishings appear to contain only a very small amount of the active substance. The authors conclude that the polyneuritis induced in birds by a diet of decorticated and polished rice is not due to the deficiency of phosphorus compounds, but to the absence of some substance not of protein nature, devoid of phosphorus, soluble in water and acidulated alcohol, dialysable, and precipitated by phospho-tungstic acid. The precise nature of this substance is now being searched for by several observers.

**"Journal of the Royal Army Medical Corps," No. 4, October, 1911, vol. xvii.**

PNEUMONIC PLAGUE.

Major Cunningham reports on a small outbreak of pneumonic plague which occurred amongst men of the band of the 1st Battalion Royal Scots, stationed at Allahabad. Out of three cases two died and one recovered. The cause of the outbreak could not be positively traced, but the suggestion that the infection was acquired in a dirty third-class carriage in which the band travelled to Benares is quite probable. Major Cunningham rightly draws attention to the value of routine sputum examination in all doubtful cases.

KALA-AZAR.

Baker and Babington in different papers call attention to the presence of kala-azar in Malta. This disease, once recognized in Sicily, Malta and the Southern parts of Italy, is now being shown to be quite common. It seems strange it was not detected and diagnosed long ago. Babington gives some interesting details of the recent bibliography of the subject in the Mediterranean. He states, as regards prevention, that the keeping of dogs in dwelling houses should be discouraged, and absolutely prohibited where there are young children.

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DECEMBER 1, 1911.


## SEA-WATER AS A THERAPEUTIC AGENCY.

THE recent advocacy of sea-water as an agent in treating intestinal ailments created considerable attention in London on the part of the newspapers. It was impossible to attempt to even refer to the subject while the *furore* was upon us; but now that the excitement has subsided, and the treatment perhaps ceased to be used, the question may be dealt with, with less chance of acrimonious discussion. The treatment was applied in the case of children especially suffering from summer diarrhœa, and the majority of the patients were reduced to a state of marasmus in many instances when brought for treatment. That a hypodermic injection of a saline fluid in this state would tend to bring about improvement in the patient's condition is a well-understood axiom, and one often relied upon as a potent method in cases of urgency. That sea-water *per se* was responsible for the alleged or actual "cures" is another matter, and one which should be considered.

Sea-water in our grandfathers' time was regarded as a remedial agent of considerable value. When the inland people, in the middle of last century, went to the seaside for a change they "took the waters," not in the form of baths, as is the case at the present day, but they drank the sea-water, and cleansed thereby, not the outside of their bodies, but their gastro-intestinal tract. Baths in any form were discounted in that period of our history, and the visit to the sea was not so much regarded as beneficial from the change of air, but for the "change of water" obtainable. In most Oriental countries to-day a "change of water" is advocated as a remedial measure in the same way as we speak of a "change of air," and the visit to the seaside amongst ourselves until recently was spoken of in the same way.

That sea-water has a purgative and alterative action when taken internally we know, but that sea-water in minute quantities, given hypodermically, can have any direct action upon the alimentary canal is another question. By improving the general condition the hypodermic treatment will find many adherents amongst medical men, but further than that one is not prepared at present to go. It is only by experience that the matter can be settled, and we have not had sufficient experience to justify the conclusion that sea-water, given hypodermically in minute quantities, is beneficial in intestinal flux. The writer can quote two cases of intestinal flux of tropical origin which were treated at the recognized headquarters of this mode of treatment in London, and in both cases the results were such that the patients had to give up going, on account of the serious condition they were brought to. In each case the temperature rose gradually during the process of treatment, the flux continued, weight to a considerable degree was lost, and the weakness after several weeks became so great that they could go no more. In one case the temperature gradually rose to 103° F., but even with this amount of feverishness the patient persisted in going for treatment, and it was only when unable to get out of bed that it was given up. The relation of the condition to the treatment may have been accidental, but, on the other hand, it may have been cause and effect; at any rate, when it was given up improvement at once began.

Sea-water for intestinal ailments, such as colitis, post-dysenteric flux, diarrhœa of a tropical origin, &c., is undoubtedly a remedy of value when given by way of the bowel. Enemata of sea-water has no superior, nor any equal, in cases of the kind referred to. Salt-and-water enemata, or even the rock salt obtained from Droitwich and elsewhere, dissolved in water and injected into the bowel, have not the same effect as sea-water itself. Salt in any form is but the precipitate from the sea-water, and does not contain the ingredients of sea-water.

The multitude of these ingredients it is well-nigh impossible to enumerate, and they vary in relative quantities, according to the place where the water is collected. It is a question, also, which of these ingredients are the potent agency for good, and it is plain that the chloride of sodium is not the only substance which does good. The

effect of an enema of warm sea-water in a case of long-standing colitis, of post-dysenteric diarrhœa, or chronic dysentery is to bring away a large quantity of mucus, an amount altogether in excess of the quantity that salt and water, however concentrated, accomplishes. The presence of mucus in such cases indicates the presence of a medium suitable for the perpetuation of the germs; the toxin, or the ferment on which the continuance of these ailments depend, and any application which clears the mucous membrane of this substance, is calculated to benefit, and than sea-water no other fluid, medicated or not, is so potent. The sea-water must be collected at a distance from the shore, warmed to the temperature of the body (not boiled and cooled), and one to two pints slowly thrown up the bowel after a stool has been passed. The injection should be given every second day for a week, and twice weekly for two, three, or four subsequent weeks, and at longer intervals should mucus, although lessened in amount, persist.

The introduction of sea-water as a mode of treatment is but a revival of a previously valued remedy, but as to the best mode for administration experience alone can settle.

J. CANTLIE.

## Annotations.

*Classification of Trypanosomes.*—Bagshawe, in the *Bulletin of the Sleeping Sickness Bureau* for October, 1911 (No. 30, 1911, vol. III), gives Laveran's recent classification of the trypanosomes—a paper which appeared in the *Annales de l'Institut Pasteur*, 1911, July 25, No. 7. The paper deals with the identification and classification of mammalian trypanosomes only. The classification is as follows:—

*Classification of Mammalian Trypanosomes.*

Laveran does not accept the genus *Trypanozoon* which Lühe has proposed for mammalian trypanosomes; he thinks that the time has not yet come to create new genera; he divides them into two large groups according as they are or are not pathogenic.

*Non-pathogenic Trypanosomes.*

These comprise (1) the trypanosomes of small mammals; (2) the large trypanosomes of bovines. These parasites are almost always specialized to one species or to several neighbouring species. After an active period of multiplication they become very rare in the blood, or they may remain for a long time in a latent state. Animals which recover are immune. Non-pathogenic trypanosomes are easily cultivated by appropriate methods. To such an extent is this the case that culture is often the most convenient method of establishing their presence.

(1) *Non-pathogenic Trypanosomes of Small Mammals.*—Most of these are of the *lewisi* type, and the principal specific character is furnished by the fact that they are not inoculable from one animal species to another. He divides them according to their hosts into trypanosomes of rodents, which are the most numerous; of bats; of *Insectivora;* of *Edentata;* and of *Carnivora.*

(*a*) *Trypanosomes of Rodents.*—Each is mentioned in turn, with the name of the host and the distribution. They are: *T. lewisi*, Kent (including *T. longocaudense*, Lingard); *T. duttoni*, Thiroux, found in *Mus musculus; T. grosi*, Laveran and Pettit, found in *Mus sylvaticus; T. microti*, Laveran and Pettit, found in *Microtus arvalis; T. blanchardi*, Brumpt, found in *Myoxus nitela* (probably includes *T. myoxi*, Blanchard); *T. criceti*, Lühe, found in the hamster; *T. spermophili*, found in *Spermophilus musivus; T. cuniculi*, Blanchard, found in the rabbit; *T. indicum*, Lühe, found in the Indian squirrel; *T. otospermophili*, found in the Californian squirrel.

(*b*) *Trypanosomes of Bats.*—These include *T. vespertilionis*, Battaglia, and *T. megadermæ*, Wenyon, the latter found in the Anglo-Egyptian Soudan.

(*c*) *Trypanosomes of Insectivora.*—*T. talpæ*, Nabarro, found in moles in England and Portugal.

(*d*) *Trypanosomes of Edentata.*—*T. Legeri*, Mesnil and Brimont, found in an ant-eater; this is not at all like *T. lewisi.*

(*e*) *Trypanosomes of Small Carnivora.*—*T. pestanai*, Bettencourt and Franca, found in a badger in Portugal.

(2) *Large Non-pathogenic Trypanosomes of Bovidæ.*—These are *T. theileri* (Laveran) and *T. ingens* (Bruce). Such trypanosomes as *T. americanum* and *T. franki* are probably to be assigned to *T. theileri.*

*Pathogenic Trypanosomes.*

These are divided into three main groups:—

(1) Trypanosomes which have always a free flagellum.
(2) Trypanosomes without a free flagellum.
(3) Trypanosomes having forms with free flagellum and forms without free flagellum.

(1) The following trypanosomes are pathogenic for most mammals:—*T. evansi, annamense, togolense, brucei, soudanense, hippicum, venezuelense*, and *equinum.* The last is easily distinguished by the absence or small size of the centrosome or blepharoplast. *T. cazalboui* and *equiperdum* are very slightly or not at all pathogenic for certain mammals. The principal characters of the trypanosomes of this group are given with the mode of transmission as far as it is known.

(2) This group contains four trypanosomes—*T. dimorphon, congolense, pecorum*, and *nanum.* The first three are pathogenic for most mammals, the fourth for ruminants only. The principal characters are then set down. The *T. dimorphon* referred to is *T. dimorphon* (Laveran and Mesnil); it is said to be spread by tsetse flies, especially *Glossina palpalis. T. pecorum* has a great resem-

blance to *T. congolense*, but is more virulent. Animals immune to *congolense* and *dimorphon* are susceptible to *pecorum*.

(3) This group contains two trypanosomes—*pecaudi* and *gambiense*.

*Doubtful or insufficiently known species.*—This group contains *T. vivax* (Ziemann), *T. suis* (Ochmann), *T. wrubleskii*, *T. montgomeryi*, *T. elephantis*, *T. capræ* (Kleine), *T. uniforme*, *T. rhodesiense* (Stephens and Fantham), *Schizotrypanum cruzi* (Chagas), *T. prowazeki* (von Berenberg Gossler), *T. minasense* (Chagas), and *T. vickersæ* (Brumpt). The last three are found in monkeys. *T. vivax* is said to be pathogenic for the dog and the rat; it is probable, Laveran thinks, that two species at least have been described under this name. He suggests that *T. elephantis* is *T. soudanense*.

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*Cholera.*—McLaughlin, of Washington, contributes an interesting paper on "The Bacteriological Examination of Stools as a Measure of Quarantine Protection against Asiatic Cholera" to the *Boston Medical and Surgical Journal*, for October 12, 1911 (vol. clxv., No. 15). The method, he believes, is specially useful in dealing with immigrants. For securing the specimen magnesium sulphate may be given. It is best administrated on an empty stomach about 6 a.m. Passengers with diarrhœa and children may be exempted, and a good specimen may be obtained from these by passing a large catheter or rectal tube with several "eyes" cut in the upper end. In withdrawing the tube the "eye" scrapes mucus off the lining of the bowel and furnishes a very good specimen. The use of swabs is not recommended, as a good specimen is difficult to obtain if the patient is constipated. The swab has a great deal of the material scraped off by the tight sphincters and further may cause considerable pain and injury, especially when hæmorrhoids are present. Dr. Serrati, the Italian Royal Commissioner at New York, suggested that the swabs be sheathed in glass tubes. The tube protects the swab in passing the sphincters, and is also less painful in passing. The only objections raised against the salts are the danger of infections from the handling of so many stools, and the danger to the patient of administering a dose of salts. The first objection is not valid if the "handling" is properly done. In regard to the danger of giving a dose of salts, one case is cited at New York as having been a carrier who, after having calomel and salts, went down with cholera and died.

As a matter of fact, salts were administered at Boston and Providence in about 2,000 cases without any ill-effects. According to Zirolia, the administration of a saline purge made manifest cholera vibrios in the dejections of a convalescent after his stools had been negative for three weeks, which would indicate that the saline assists in the detection of carriers, especially if we have such a thing as intermittent carriers.

The specimen should be passed in a paper sanitary cuspidor or similar receptacle, which is cheap and may be burned. After making the cultures the stool and container is dropped in a flour barrel. When the barrel is full or the samples all taken the cover is placed and the barrel with its contents burned.

The specimens are planted in peptone by means of sterile pieces of wood (an ordinary wooden tongue depressor split in three serves very well). This obviates the necessity of sterilizing a platinum loop or other metal instrument and saves much time. After planting, the stick is destroyed with the specimen in the barrel.

Smears are then made after an incubation from 35° to 37° C. for about six hours. These are then stained in carbol-fuchsin diluted by the addition of nine parts of water for about one minute, washed carefully and then examined. This examination is the most important step in the technic, as if carelessly done the whole examination is valueless. If properly done, 80 to 90 per cent. of the specimens may be rejected without plating. The observer must search, using a mechanical stage, from twenty-five to fifty fields, and if he finds no suspicious curved organisms, the specimen is marked negative. If he finds curved organisms, a sub-culture in peptone and plates are made. To be able to do this requires acute vision, and a knowledge of vibrios and other curved forms, The observer at first finds curved organisms in nearly every specimen. But after plating these out he finds that many are not vibrios at all. At first the beginner will plate out about four-fifths of his specimens. After training and the experience gained by studying his plates, he will not find it necessary to plate more than 10 per cent. The differentiation of what seem to be curved organisms and vibrios can only be learned by actual experience, and safety at first lies in plating all the doubtful ones. At Boston the bacteriologists had about two weeks' steady training before the first large vessel arrived. There had been a case of cholera in Boston about the time the training started and the men had the advantage of working with a freshly isolated culture for practice.

Plates when necessary should be made of ordinary nutrient agar, and they should be examined after about sixteen hours. McLaughlin believes that after bacteriological examination steerage passengers may be discharged in forty-eight hours with greater safety than after five days of detention and observation only.

No bacteriologic procedure, however, can afford absolute protection if intermittent and long-time carriers have to be dealt with.

The method used gives a large measure of protection, much greater than mere detention and observation, and the additional safeguard is furnished with the minimum restriction of commerce.

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*Chronic Dysentery.*—Bassler, in the *Medical Record*, October 7, 1911, gives his results of a study of four cases of chronic dysentery, non-amœbic in Nature. He states that the bacterial

deductions observed by him in these cases suggest the following conclusions:—

(1) That there is a chronic form of dysentery due to the *B. coli communis*, and that these cases are not uncommon in temperate climates.

(2) That the form of infecting organisms does not correspond to the Shiga or the mannite-fermenting types, and that they are not possible of differentiation from the known forms of *B. coli communis* of high virulence.

(3) That the serums from the cases strongly agglutinated the organisms obtained from that person, and more definitely than they did the strains of *B. coli communis* obtained from innocent sources.

(4) That the organisms were most fatal to lower animals, decidedly more so than in one's experience with the human *B. coli communis* ordinarily obtained and used in laboratory observations.

(5) That the organisms existed in large numbers in the lower intestinal tract of the cases, mostly in the mucus, and that they were capable of destruction of tissue locally with the production of ulcers and then living within the tissue of the gut wall in the bases of them.

(6) That in the etiology of these cases we are dealing either with a definite organism of the *B. coli* group, or with *B. coli communis* of a high virulence, strongly hemiparasitic in nature and from which the aggressin production is overwhelming, and against the effects of which in susceptible individuals the body cannot resist local tissue infection.

(7) That the clinical entity "Chronic dysentery due to the *B. coli communis*" seems warranted and further, that there is reason for the belief that in the production of this disease we are dealing with an organism of the colon group specialized in nature.

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*Plague.*—Dr. McCoy, of San Francisco, writes in the *Journal of the American Medical Association* of October 14, 1911, on "Bubonic Plague, with Special Reference to that of Ground Squirrel Origin." Articles on this important source of infection have been noted in the JOURNAL OF TROPICAL MEDICINE AND HYGIENE already.

As Dr. McCoy says, two or three years after plague had been recognized in San Francisco, several cases of the disease occurred among persons living in the rural districts in the country across the bay from San Francisco. Surgeon Rupert Blue, of the Public Health and Marine Hospital Service, noted in one or two instances that the disease occurred in those who had hunted ground squirrels a few days prior to the onset of the illness, and he suggested that since there had been no contact with human plague, and no known opportunity for infection from rats, the disease might be present in the squirrels, and be communicated from them to man.

During the past three years Dr. McCoy has conducted the bacteriologic investigations in eleven cases of plague of ground squirrel origin. Seven of these patients were seen clinically, and the diagnosis verified by laboratory methods, while in four the diagnosis was made from the bacteriologic examination of tissues taken at autopsy and sent to the laboratory. Six of these patients, all from the known infected zone, gave a clear history of handling ground squirrels within a week prior to the onset of the symptoms. Five gave no such history although they had been in vicinities where plague was known to exist among the ground squirrels at the time, or where it was demonstrated as a result of the investigations set in motion by the discovery of the disease in man. Of these eleven patients, seven were young men between the ages of 13 and 37; one was a boy aged 5; another a boy aged 7; while two were young women. Six of these proved fatal, while five recovered.

No case of primary pneumonic or primary septicæmic plague attributable to ground squirrel infection came under observation.

The subject of the transmission of the disease from one squirrel to another, and from these rodents to man, is a very important one, and Dr. McCoy regrets that he has no conclusive evidence about the mode of infection. He has, however, been able to show experimentally that plague may be carried from squirrel to squirrel by means of fleas. It may also be transmitted by feeding. What evidence there is, largely dependent on the location of the bubo, leads him to suspect that the disease is conveyed in Nature by fleas, and possibly by other ecto-parasites. Briefly, this evidence, the importance of which in rat plague has been demonstrated by British workers in India, is as follows: In natural infections in rodents the bubo is found in the region of the peripheral glands, cervical, axillary, inguinal or pelvic. This agrees with the distribution of buboes in squirrels, rats and guinea-pigs that have been infected experimentally by fleas, while in rodents infected by feeding, the buboes are always in the neck or in the mesentery. It will be noted that the neck buboes may be acquired in either way, *i.e.*, through fleas or by ingestion.

In one of Dr. McCoy's cases the patient, a boy, was bitten on the hand by a squirrel, and since the primary bubo occurred in the axilla on the same side, it seems reasonable to suppose that the bite infected the boy. This was rendered probable as many plague squirrels have lung lesions. Most of the cases occurred during the summer months, which is the season of squirrel hunting. That the mere handling of an infected animal is not very dangerous is shown however by the fact that the employees of the Service have handled hundreds of plague squirrels without an accident, merely taking precautions against fleas.

The predominance of axillary buboes in human cases would appear to be accounted for by the fact that in handling infected squirrels which may carry parasites, the hands and arms would be more exposed to the attacks of the insects than other parts of the body. One cannot assert positively that parasites

carry the disease to man, but it seems to be the most reasonable explanation.

The danger of the spread of the disease from these ground squirrels to rats, especially in the neighbourhood of towns, would seem to be a real one and Dr. McCoy recognizes this. Destruction of ground squirrels and rats alike would seem to be the most likely remedy for such a contingency.

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*Leishmania and Mosquitoes.*—Wenyon, writing in the *Lancet* of November 11, 1911, in reference to a paper by Professor Franchini on the development of *Leishmania donovani* in anopheles, calls attention to the fact that in his (Wenyon's) reports upon Oriental sore in Bagdad, which have appeared in the "Report of the Advisory Committee for Tropical Disease Research Fund" (February, 1911), the JOURNAL OF TROPICAL MEDICINE AND HYGIENE (April 1, 1911), and the *Journal of Parasitology* (October, 1911), he has given an account of experiments conducted with *Leishmania* and mosquitoes. He found that *Stegomyia fasciata* would feed readily upon the non-ulcerating form of Oriental sore, and that in so doing it took into its gut numbers of *L. tropica*. In the intestine of the mosquitoes the parasites underwent a development into flagellates and other forms which have been described and figured in his report in the last number of the *Journal of Parasitology*. In view of his findings the results of Professor Franchini he considers are very interesting. Wenyon points out that the *L. tropica* undergoes a similar development in the gut of the bed bug of Bagdad, but owing to the fact that for reasons of distribution the bed bug cannot possibly be the natural intermediate host of the *Leishmania* of Oriental sore in Bagdad, he has been driven to the conclusion that the parasite of Oriental sore develops in the intestine of the bed bug in just the same way as in artificial cultures in various blood-containing media. In connection with Patton's discovery of the development of *L. donovani* in the bed bug, Mesnil has made the same suggestion, so that such a development does not necessarily mean that the insect in question is the natural host of the parasite. It is highly probable that the parasites of the group *Leishmania*, will develop to a certain extent in the intestines of many insects, provided that they find there a suitable pabulum rich in blood. The development Wenyon has described of *L. tropica* in *Stegomyia fasciata*, and that of *L. donovani* in anopheles described by Professor Franchini, may be of this nature, and only, so to speak, accidental, owing to the rich nutrient fluid taken up with the parasites by these blood-sucking flies. Wenyon failed to infect himself with Oriental sore by means of the bites of *Stegomyia fasciata* previously fed on Oriental sore, so there is no evidence that the development in the mosquito is a natural one. Conclusions can only be drawn when we know, not only that the *Leishmania* develops into flagellates and other forms in any insect's gut, but that this insect also is able to transmit the infection to healthy animals as a result of transmission experiments.

## Reviews.

RATIONAL IMMUNIZATION IN THE TREATMENT OF PULMONARY TUBERCULOSIS AND OTHER DISEASES. By E. C. Hort, B.A., B.Sc., M.R.C.P. John Bale, Sons and Danielsson, Ltd., 83-91, Great Titchfield Street, Oxford Street, London, W. 1909. Pp. 75. Price 3s. 6d. net.

Those who have not read this interesting work by Dr. Hort would do well to do so. The author brings new ideas to bear on immunization, and endeavours, we think successfully, to divert our minds from the thraldom which tends to limit our range of thought and to focus our attention too much upon bacteria and their products as the predominating factors in disease.

The limited success of what the author terms "hetero-incubation," that is, inoculation of immune serums and of tuberculin and other vaccines from without, has induced him to take a wider view of the matter, and to bring forward such important factors in the sum-total of infection or autolysis, and other anomalies of cell-metabolism, as well as the toxic products of such anomalies. The author maintains that spontaneous auto-inoculation, being a process of natural cure of infection by auto-serum and auto-vaccine therapy, incites the restraint of all the factors concerned and that artificial auto-infection is superior to hetero-inoculation. The importance of measuring the antitryptic powers of the blood is brought prominently forward, and we are introduced to a novel method of interpreting temperature charts in terms of immunity curves. Apart altogether from the benefits to the study of tuberculosis accruing from the study of this book, the reader will find the principle brought forward applicable to almost the whole range of the treatment of disease by serums, vaccines, &c., and will feel thankful to the author for having afforded him a wider view and placed the subject on a higher platform than has been the case heretofore.

VOLUME XXIV. of E. Merck's "Annual Report of Recent Advances in Pharmaceutical Chemistry and Therapeutics" is now to hand. The report is a brief and impartial epitome of the therapeutic acquisitions of the last twelve months. The present volume comprises 380 pages of literary matter, the first sixty-three pages dealing with the therapeutic use of the cacodylates. Other new drugs are treated of in the latter pages. There is a wide appreciation of this Annual Report and it is no exaggeration to say that it is very often consulted as a book of reference now. Its chief merit, of course, is its complete impartiality.

# Notice.

## THE SOCIETY OF TROPICAL MEDICINE AND HYGIENE.

AT a meeting of the Society of Tropical Medicine and Hygiene, held at 11, Chandos Street, Cavendish Square, London, W., on Friday, November 17, 1911, the following gentlemen were elected Fellows:—Clement J. Baker, M.R.C.S., Uganda; Alexander Brown, M.B., Serenje, Rhodesia; H. B. Fantham, D.Sc., Liverpool; J. C. Fox, M.R.C.S., N. Nigeria; H. J. Gibbs, M.R.C.S., Singapore; Major E. D. W. Greig, I.M.S., Kasauli; Professor F. K. Kleine, Dar es Salam, German E. Africa; George Prentice, L.R.C.P., Kasungu, Nyasaland; Harald Seidelin, M.D., Liverpool; R. Yelverton Stones, M.B., M.R.C.S., S. Nigeria.

# Personal Notes.

INDIA OFFICE.

*From October 21 to November 11.*

*Arrivals reported in London.*—Captain D. N. Anderson, I.M.S.; Captain R. D. MacGregor, I.M.S.; Lieutenant-Colonel W. R. Edwards, I.M.S.; Lieutenant-Colonel P. C. H. Strickland, I.M.S.

*Extensions of Leave.*—Lieutenant-Colonel P. J. Lumsden, I.M.S., B., 1 d.; Captain B. Munro, I.M.S., B., 3 m.; Captain C. H. Reinhold, I.M.S., to March 14, 1912.

*Permitted to Return.*—Captain T. W. Barrett, I.M.S.; Captain R. G. G. Croly, I.M.S.

LIST OF INDIAN CIVIL OFFICERS ON LEAVE (INCLUDING MILITARY OFFICERS UNDER CIVIL RULES).

*Showing the Name, Province, and Department, and the Period for, and Date from, which the Leave was granted.*

Browne, Captain E. W., I.M.S., M., 15 m., July 18, 1911.
Clarkson, Lieutenant-Colonel F. C., I.M.S., B. Med. Dept., 24 m., March 1, 1910.
Cornwall, Major J. W., I.M.S.
Emslie-Smith, Captain H., I.M.S., B., 24 m., September 14, 1911.
Harrison, Major C. B., I.M.S.
Heard, Major R., I.M.S., 3 m., July 13, 1911.
Kemp, Major D. C., I.M.S.
Melville, Major H. G., I.M.S.
Munro, Captain D., I.M.S.B., 15 m., December 1, 1910.
Prall, Lieutenant-Colonel S. E., I.M.S., Aden.
Sykes, Lieutenant-Colonel W. A., D.S.O., I.M.S., Beloochistan, 19 m. 1 d., December 16, 1910.
Turner, Major R. G., I.M.S., U.P., 9 m. 4 d., April 11, 1911.
Walker, Captain E. A., I.M.S., Burma, 24 m., June 10, 1911.
Wells, Captain N. S., I.M.S., U.P., 13 m., May 13, 1910.

LIST OF INDIAN MILITARY OFFICERS ON LEAVE.

*Showing the Name, Regiment, or Department, and the Period for which the Leave was granted.*

Babington, Captain J. W. H., I.M.S.
Earle, Major H. M., I.M.S., 12 m., from June 24, 1911.
Grainger, Colonel T., I.M.S., to January 1, 1912.
Greany, Lieutenant-Colonel H., I.M.S., 2 y., from April 28, 1910.
Groube, Major G. P. T., I.M.S., 1 y., from August 23, 1911.
Lloyd, Captain R. A., I.M.S., to December 16, 1911.
Lloyd, Lieutenant R. B., I.M.S., 8 m., from July 29, 1911.
MacGregor, Captain R. D., I.M.S.
Swinton, Major F. E., I.M.S., 8 m., from April 19, 1911.
Tresidder, Lieutenant A. G., I.M.S., 8 m., from June 24, 1911.
Wright, Captain R. E., I.M.S.

# Recent and Current Literature.

*A list of recent publications and articles bearing on tropical diseases is given below. To readers interested in any branch of tropical literature mentioned in these lists the Editors of the* JOURNAL OF TROPICAL MEDICINE AND HYGIENE *will be pleased, when possible, to send, on application, the medical journals in which the articles appear.*

### "The Archives of Internal Medicine," October 15, 1911.

Friedman, writing on typhus fever, concludes that (1) Typhus fever occurs sporadically in many regions. (2) Mortality from typhus fever no longer reaches the high figures quoted by old observers of the disease. (3) Typhus is little contagious wherever good ventilation, abundance of light, and good hygienic conditions exist. (4) Epidemics of typhus may occur at very infrequent intervals, even where the disease is endemic. (5) Brill's symptom-complex is identical with mild and moderately severe cases of typhus fever.

### "Sleeping Sickness Bureau Bulletin," No. 31, 1911, vol. iii.

The November number of the above bulletin contains the following papers: (1) The transmission of trypanosomes; (2) Sheep and goats as sleeping sickness reservoirs; (3) Treatment; (4) Blood changes in trypanosome infections; (5) The human trypanosome in vertebrate blood; (6) Bionomics of tsetse flies; (7) Antibodies—immunization; (8) The animal trypanosomes of Nigeria and other papers; (9) Sleeping sickness news; (10) Monthly list of references.

### "Bulletin of Entomological Research," October, 1911, vol. ii, part 3, pp. 187-278.

The contents of the above number of the *Bulletin of Entomological Research* are as follows: (1) The African species of culex and allied genera (illustrated), by F. W. Edwards; (2) Notes on the blood-sucking flies of Oshogbo and Ilesha Districts, Southern Nigeria, by Dr. T. F. G. Mayer; (3) On a new genus and species of Siphonaptera from Nyasaland, by the Hon. N. Charles Rothschild; (4) Entomological Research in British West Africa—I, Gambia, by James J. Simpson.

### "The Journal of Hygiene," vol. ii, No. 3, October, 1911.

*Bacillus coli and house flies.*—Nicoll, writing in *The Journal of Hygiene* on the varieties of *Bacillus coli* associated with the house-fly (*Musca domestica*) concludes that the house-fly may carry at least twenty-seven varieties of *Bacillus coli*, by far the most frequent of which are *B. coli communis* and MacConkey's bacillus No. 71. As far as can be judged from the character of these colon bacilli the house-fly derives its bacterial flora equally from excremental matter and from other sources. Certain non-lactose fermenting bacilli appear to be capable of multiplying in the intestine of the house-fly—of these Morgan's bacillus No. 1 is a not infrequent inhabitant of the fly's intestine and *B. paratyphosus* B has been found on two occasions.

# Notices to Correspondents.

1.—Manuscripts sent in cannot be returned.

2.—As our contributors are for the most part resident abroad, proofs will not be submitted to those dwelling outside the United Kingdom, unless specially desired and arranged for.

3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.

4.—Authors desiring reprints of their communications to the JOURNAL OF TROPICAL MEDICINE AND HYGIENE should communicate with the Publishers.

5.—Correspondents should look for replies under the heading "Answers to Correspondents."

## Original Communication.

# THE ETIOLOGY OF BERI-BERI.*

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(*Continued from p.* 358.)

### THE EFFECT OF EXPOSURE TO HIGH TEMPERATURES.

At this point the various methods of analysis suitable for the recognition of the physiologically active substances were reviewed. The methods hitherto employed for the recognition of specific differences among the various rices and rice products experimented with had always involved the exposure of these substances to high temperatures.

Bearing in mind the results obtained by Grijns in his experiments with kachang idju (*Geneeskundig Tijdschrift voor Nederlandsch Indie*, 1901), and by Holst and Fröhlich [18] with various meats and vegetables, it was decided to test the effect of exposure to high temperatures on the materials with which we were working.

The first substance experimented with was the rice polishings. Quantities of polishings sufficient for six fowls for one day were mixed with water in flasks and heated in the autoclave for one hour at 120° C. In Experiment No. 38 a group of fowls on a white polished rice diet were each given daily a portion of the emulsion so prepared equivalent to 5 grm. of polishings. No cases of polyneuritis appeared among them in the five weeks during which the experiment was in progress.

In the next experiment, No. 39, polishings heated for two hours at 120° C. were employed. One fowl died in the third week of the experiment without showing the clinical signs of polyneuritis or the characteristic nerve changes on *post-mortem* examination.

This unexpected result caused us to initiate further experiments to determine whether physical conditions, apart from the temperature, were responsible for this result.

In Experiment No. 40, padi, which had been sterilized in a small bag suspended in the wire basket of the autoclave for one hour at 120° C., was employed. One group of six fowls were fed on this, and another group were fed on the untreated padi. This experiment gave a result identical with that of other observers.

In Experiment No. 41, unpolished rice was employed. Four fowls were fed on unpolished rice untreated. Four fowls were fed on unpolished rice, sterilized in a porcelain basin in the autoclave for one hour at 120° C. Four fowls were fed on unpolished rice sterilized for two hours in the same way. The results of these experiments showed that when sterilized in an atmosphere of steam for one or two hours at 120° C. the physiological activity of the protective substances was destroyed.

In Experiment No. 42, padi immersed in water in a porcelain basin and sterilized in an autoclave for one hour at 120° C. was employed. The fowls remained healthy.

In Experiment No. 43, padi sterilized for one hour at 120° C. in a hot-air sterilizer was employed. The fowls remained healthy.

In certain large institutions rice is cooked by steam under pressure. By this method larger quantities are dealt with than by cooking in open vessels and the cooking is presumably more quickly carried out. An opportunity of making a practical test of the relative merits of these two methods of cooking we owe to the courtesy of Dr. Gray and Dr. Freer.

In Experiment No. 44 a group of fowls was fed on parboiled rice, cooked in the usual way in open vessels. All the fowls remained healthy.

In Experiment No. 45, the same rice cooked by steam under pressure as issued to the inmates of a large institution was fed to a group of fowls. The cooking process involved exposure to steam under a pressure of two atmospheres at 120° C. or thereabouts for two and a half hours. The fowls in this group rapidly lost weight and cases of polyneuritis developed among them.

These experiments showed that physical conditions other than temperature influenced the result; immersion in water, for example, in the case of padi, seemed to negative entirely the destructive effect of an atmosphere of steam under the conditions which obtain in an autoclave. This series of experiments has not been carried to a conclusion, but there is evidence that the destructive effect of high temperatures is complicated by the consideration of other physical conditions.

It was evident, however, that methods of analysis involving exposure of the materials to high temperatures would not enable us to determine the nature of the substances for which we sought and recourse was had to other methods.

### EXPERIMENTS TO ISOLATE THE PROTECTIVE SUBSTANCES CONTAINED IN RICE POLISHINGS.

From this point researches were carried out for the isolation of the substance or combination of substances in polishings which were responsible for this result.

For the purpose of testing the value of the various materials fowls weighing 1,200 grm. or thereabouts were employed. Each, as in previous experiments, was confined in a separate cage. The fowls received rice twice daily at 10 a.m. and 3 p.m. and when receiving polishings or materials prepared from polishings the substance in question was

* Studies from the Institute for Medical Research, Federated Malay States. No. 12. Singapore: Kelly and Walsh, Ltd., Printers, and at Shanghai, Hong Kong, and Yokohama. 1911.

given as an emulsion by means of a stomach-tube half an hour after the rice had been given. Every fowl was weighed once a week at 12 noon.

As the result of a series of observations it had been determined that fowls weighing from 1,200 to 1,400 grm. required about 60 grm. of unpolished rice daily and, if fed on 60 grm. of the polished rice used in these experiments, they required in addition 5 grm. of sifted polishings for the maintenance of weight and health.

In a previous experiment where products derived from different lots of padi were employed, 3.5 grm. of the polishings were shown to be sufficient with the white rice then in use. In the present experiment all the products employed, unpolished rice, polished rice, polishings, &c., were derived from the same lot of padi.

For purposes of comparison, the following results of analyses are given:—

| | Protein | Fats | Carbo-hydrates | Ash | Moisture | Percentage of $P_2O_5$ |
|---|---|---|---|---|---|---|
| Polishings (sifted) | 13.7 | 14.16 | 52.77 | 7.54 | 11.83 | 4.1 |
| Unpolished rice... | 9.0 | 1.65 | 75.52 | 1.08 | 12.75 | 0.56 |
| Polished rice ... | 8.6 | 0.22 | 76.23 | 0.6 | 14.35 | 0.26 |

When the composition of these articles is calculated on dried materials the differences are rendered more striking and accurate, and when in a similar manner the composition of a diet made up of 60 grm. of polished rice and 5 grm. of polishings is calculated it will be seen how closely such a diet approximates to one of unpolished rice.

Calculated on Dried Materials.

| | Protein | Fats | Carbo-hydrates | Ash | Percentage of $P_2O_5$ |
|---|---|---|---|---|---|
| Polishings (sifted) ... ... | 15.5 | 16.0 | 60.0 | 8.5 | 4.65 |
| Unpolished rice ... ... | 10.3 | 1.89 | 86.58 | 1.23 | 0.64 |
| Polished rice... ... ... | 10.0 | 0.25 | 89.05 | 0.7 | 0.3 |
| Ration 60 grm. polished rice plus 5 grm. polishings contains per cent. ... | 10.4 | 1.5 | 86.8 | 1.3 | 0.64 |

Sifted polishings were invariably employed because polishings as received from the millers contain a considerable admixture of husk and broken rice.

Polishings when fresh are neutral in reaction, but on keeping they become acid. This change does not impair their efficiency, however, and polishings which have been stored with ordinary care for months are quite as valuable as the fresh materials. The ordinary process of cooking does not impair the value of polishings. For these reasons it is considered that the essential substance or substances are not unstable.

## Experiments to Determine the Value of Fat in Polishings.

Fat in the rice-grain is mostly confined to the subpericarpal layers. Unpolished rice is therefore richer in fat than polished rice, and polishings are very rich in fat.

To determine the value of this fat, a quantity of sifted polishings was packed in a percolator and percolated repeatedly with petroleum ether. In this way the amount of fat in the polishings was reduced from 14.16 per cent. to 0.6 per cent. The fat-free polishings were dried by exposure to the sun until free from petroleum ether.

Twelve fowls were fed on polished rice and received in addition daily 4.5 grm. of fat-free polishings, being the approximate equivalent of 5 grm. of sifted polishings (Experiment No. 46). The fowls remained healthy and maintained their weight just as had been the case when fowls received polished rice and sifted polishings. The non-importance of fat was therefore decided, and its exclusion from the number of possibilities was of the utmost value, since the fat had hitherto complicated our experiments.

## Experiments with the Substances Soluble in 0.3 per cent. Hydrochloric Acid.

Estimations of the percentage of phosphorus pentoxide in rices had consistently shown their value as indicators of the liability or otherwise of a given rice to produce polyneuritis. Thus the higher the percentage of phosphorus pentoxide contained in a rice, the less liable was that rice to produce polyneuritis when fed to fowls.

The unpolished rice employed contained 0.56 per cent. phosphorus pentoxide, and did not cause polyneuritis. The polished rice contained 0.26 per cent. phosphorus pentoxide and invariably caused polyneuritis, while washed rice containing 0.22 phosphorus pentoxide was more harmful than the unwashed polished rice. This suggested the probability that the essential substance was one containing phosphorus.

Now it was known that a large percentage of the phosphorus compounds present in rice polishings were soluble in 0.3 per cent. hydrochloric acid.

An experiment was therefore carried out to determine if, when polishings were treated with 0.3 per cent. HCl, the physiologically active substances were removed.

Polishings in quantities of 180 grm., being the amount required by twelve fowls in three days, were mixed with 1,000 c.c. 0.3 per cent. hydrochloric acid, stirred during the day and the following morning filtered through a Buchner's filter. 100 c.c. of 0.3 per cent. hydrochloric acid were used to wash out the vessels. When fluid could no longer be extracted from the mass it was mixed with 600 c.c. of 0.3 per cent. hydrochloric acid stirred during two hours and thereafter filtered as before.

The extracted polishings were mixed with distilled water, nearly neutralized with sodium carbonate, and the volume adjusted to 1,080 c.c. 30 c.c. of this emulsion contained 5 grm. of polishings, less the materials dissolved out by the acidulated water.

The combined filtrates obtained from 180 grm. of polishings were nearly neutralized with sodium carbonate and concentrated at a low temperature to a volume of 1,080 c.c. 30 c.c. of this suspension contained the substances solved out by acidulated water from 5 grm. of polishings.

Twelve fowls were fed on washed polished rice, each receiving daily 30 c.c. of the emulsion of extracted polishings (Experiment No. 47). Cases of polyneuritis occurred. This experiment was repeated (Experiment 48), with similar results.

Twelve fowls were fed on washed polished rice, each receiving in addition 30 c.c. of the suspension of dissolved substances (Experiment No. 49). Cases of polyneuritis did not occur.

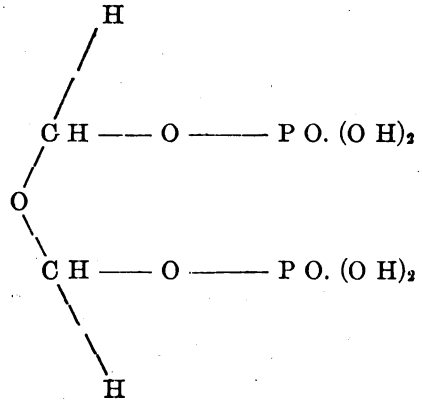
When 100 grm. of polishings are extracted in the manner described, 26 grm. of solids pass into solution. In this 26 per cent., therefore, of the original polishings are contained the physiologically active substances.

### Experiments with Phytin.

It having thus been made clear that the substances of physiological importance in polishings were removed unchanged by extracting with 0.3 per cent. HCl, the further research consisted in division of this fraction by various methods.

Of the substances contained in rice polishings which are soluble in 0.3 per cent. hydrochloric acid, an important constituent is the phosphorus compound phytin. Dr. Hans Aron has claimed that phytin is of value in preventing the onset of polyneuritis in fowls fed on a white rice diet. The results of Dr. Aron's experiments with this compound do not appear, however, to justify the claims that he has made for it.

Phytin was first isolated by Posternak from plant-seeds, and the structural formula stated by him to represent phytic acid is—



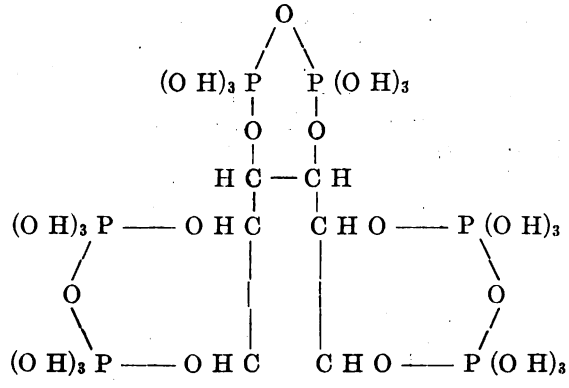
Phytin is stated to be the calcium magnesium salt of this acid, and assuming the four hydroxyl groups to be replaced by one atom each of calcium magnesium, the salt would contain 8.05 per cent. of magnesium and 13.4 per cent. of calcium. These are lesser amounts than those recorded by Contardi, who by actual analysis found 8.97 per cent. of magnesium and 13.8 per cent. of calcium.

The quantity of phytin in rice was estimated as follows. A weighed quantity of rice was reduced to coarse powder, shaken with 0.3 per cent. hydrochloric acid, and then filtered. The residue was again shaken with acidulated water, this process being repeated until the filtrate ceased to give a precipitate with either copper acetate or alcohol. To the combined filtrates excess of copper acetate was added. The mixture was allowed to stand overnight; thereafter the precipitate was collected, washed, dried, and weighed. From that weight, on the assumption that each molecule of the copper phytinate contained two atoms of copper, the amount of phytin was calculated.

It is admitted that the process is not, strictly speaking, an accurate one, but it was the best available, and was satisfactory for purposes of comparison between various kinds of rice and their content of this highly phosphorized compound.

The unpolished rice in use was by this method shown to contain 1.07 per cent. of phytin, the same rice, after polishing, yielded only a trace, and the polished rice, after washing in water, contained none.

The structural formula for phytic acid as given by Neuberg is more complex than that of Posternak, and has three times the molecular weight.



Phytin for experimental purposes was prepared by the following method. Sifted polishings were mixed with 0.3 per cent. hydrochloric acid in the proportion of 300 grm. of the former to 2,000 c.c. of the latter, the mixture was stirred throughout the day, and on the following morning was filtered through a Buchner's filter. The clear yellowish filtrate was mixed with one and a half times its volume of 95 per cent. alcohol, which produced a white precipitate of phytin; the mixture was allowed to stand for a few days. The precipitate was collected, washed with strong alcohol to free it from acid, and dried in a vacuum desiccator. A friable cake of phytin was obtained readily reducible to a white power, soluble in water, yielding an opalescent solution with an acid reaction, and giving, on addition of sodium carbonate, a white flocculent precipitate.

100 grm. of sifted polishings yielded an average of 8.47 grm. phytin. Unpolished rice loses 10 per cent. of its weight on polishing, and on this basis the percentage of phytin in unpolished rice would be not less than 0.847 per cent. In our experiments to test the value of phytin it was assumed that unpolished rice contained 1.07 per cent. of that

substance and thereby if an error did exist it was in favour of the phytin.

The phytin prepared by us contained 34.8 per cent. of phosphorus pentoxide, whereas according to the formula of Posternak, it should have contained 47.6 per cent. We proved the presence of protein in the phytin, and we considered that our preparation contained 73 per cent. of the calcium magnesium salt of an acid having the formula given by Posternak.

A fowl consuming 60 grm. of unpolished rice daily would be receiving 0.64 grm. of phytin. A fowl receiving the same amount of washed polished, and therefore phytin-free rice would require to have, in addition, that amount of phytin daily in order to bring the value of this diet in respect of phytin up to that of an unpolished rice diet.

Two experiments were carried out with this compound. In the first (No. 50) twelve fowls received washed polished rice and, in addition, phytin, which was given in the following manner: 9 grm. of phytin were dissolved in distilled water, the solution neutralized with sodium carbonate and the volume made up to 360 c.c. Each fowl received 15 c.c. of this suspension at 10.30 a.m. and 3.30 p.m. daily. All the fowls lost weight, and cases of polyneuritis occurred just as if the fowls had received washed polished rice only.

In this experiment the fowls had the phosphorus pentoxide content of their diet augmented to 0.69 per cent., an amount in excess of that contained in a diet of unpolished rice, but which, on the assumption that our phytin was only of 73 per cent. purity, meant that they received daily only 0.54 grm. of phytin in place of 0.64 grm.

In the next experiment (No. 51) twelve fowls received daily 1 grm. of phytin which was prepared as an emulsion and intimately mixed with the washed unpolished rice, but the results were the same.

Again, assuming that our phytin was only of 73 per cent. purity, each fowl received daily 0.73 grm. of phytin, an amount sufficiently in excess of the calculated amount and certainly considerably in excess in respect of phosphorus pentoxide.

As shown subsequently, the alcoholic filtrate from which the phytin had been removed, freed from alcohol, was effective in protecting fowls on unpolished rice from the occurrence of polyneuritis. The importance of phytin has therefore been disproved.

As the precipitate phytin had been shown to be ineffective, on theoretical grounds it was assumed that the whole of the active substances were contained in the filtrate.

The fraction remaining in solution after the precipitation of phytin was next tested by the following procedure.

Polishings in quantities of 180 grm. were extracted with 0.3 per cent. hydrochloric acid in the manner described, and the combined filtrates from each 180 grm. were mixed with one and a half times their volume of 95 per cent. alcohol. The precipitate was filtered off. A large number of weighings of this precipitate (phytin) were made, and it was found that an average of 8.47 grm. of phytin were obtained from 100 grm. of sifted polishings.

The alcoholic filtrate was then nearly neutralized with sodium carbonate and evaporated at a low temperature until free from alcohol. The residue was diluted with distilled water to a volume of 1,080 c.c.; 30 c.c. of this suspension contained the almost phytin-free soluble substances from 5 grm. of polishings.

Two experiments were carried out with this solution.

In the first (Experiment 52) six fowls were fed on washed polished rice, each receiving daily 30 c.c. of this suspension. All remained healthy.

In the second (No. 53) twelve fowls were employed with a similar result.

That fraction of the substances originally soluble in 0.3 per cent. HCl, which still remains in solution on the addition of alcohol, *the acid soluble, alcohol soluble part*, has thus been shown to contain the whole of the substances physiologically active, and an attempt was made to further divide this fraction by alkalinizing.

An experiment carried out with the precipitate, *the acid soluble, alcohol soluble, alkali precipitable part*, and another experiment with the filtrate, *the acid soluble, alcohol soluble, alkali soluble part*, had the unexpected result that the substances sought for were found to be no longer physiologically active in either fraction.

### Experiments with the Proof Spirit Filtrate.

Following on the demonstration that the effective substances sought for were contained in the filtrate, and therefore soluble in alcohol of proof spirit strength, experiments were undertaken with a view to isolating and testing the value of the various substances contained in that solution.

The solution was found to contain substances giving the reactions characteristic of proteins. On increasing the alcohol strength of this liquid, a precipitate was produced, and it was hoped that by sufficiently increasing the amount of alcohol the protein would be precipitated.

By experiments in which the proof spirit filtrate was nearly neutralized by means of sodium carbonate, freed from alcohol by evaporation at a low temperature, and the alcohol-free filtrate treated with varying quantities of 95 per cent. alcohol, it was found that seven volumes of this alcohol produced a precipitate which was not appreciably less than that produced when eight volumes of 95 per cent. alcohol were added. The addition of seven volumes of alcohol produced a mixture containing 83 per cent. of alcohol, with six volumes it contained 71 per cent., and with eight volumes the mixture contained 84 per cent. of alcohol. The increase of alcoholic strength being, therefore, only 1 per cent. when eight volumes were

employed in place of seven volumes, and the amount of precipitate not being appreciably increased, it was decided to carry out an experiment in which the alcohol-free filtrate was treated with seven times its volume of 95 per cent. alcohol. The following procedure was adopted.

The proof spirit filtrate obtained from 30 grm. of polishings and measuring from 650—660 c.c., was placed in a glass evaporating basin and partially neutralized. In all previous experiments the partial neutralization of this liquid had been effected by means of a solution of carbonate of soda of unknown strength, but in order to secure consistency in this and all subsequent experiments, a normal solution of carbonate of soda was employed. By experiment it was found that 13 c.c. of this solution were required for neutralization of the proof spirit filtrate from 30 grm. of polishings; 10.5 c.c. left the liquid slightly acid, and it was decided that this amount should be added to each quantity of proof spirit filtrate evaporated. The partially neutralized liquid was evaporated at a temperature of 60° C. until free from alcohol.

To the alcohol-free liquid seven times its volume of 95 per cent. alcohol were added, the mixture stirred, allowed to stand for two days and then filtered. The precipitate weighed on an average 0.7 grm. and consisted partly of phytin; it was freed from alcohol by exposure to the air and suspended in 180 c.c. of distilled water. This volume contained the substances in 30 grm. of polishings soluble in 0.3 per cent. HCl, soluble in proof spirit and insoluble in alcohol of 83 per cent. strength.

In Experiment No. 54 each of six fowls on white polished rice received daily, in addition, 30 c.c. of this suspension; cases of polyneuritis occurred.

The 83 per cent. alcoholic filtrate was freed from alcohol by evaporation at a temperature of 60° C., and to the alcohol-free residue distilled water was added to make the volume up to 180 c.c. This volume contained the substances in 30 grm. of polishings soluble in 0.3 per cent. HCl, soluble in proof spirit and soluble in 83 per cent. alcohol.

In Experiment No. 55 each of six fowls on white polished rice received daily, in addition, 30 c.c. of this solution, and cases of polyneuritis did not occur.

It was observed that when the 83 per cent. alcoholic filtrate stood a few days a further slight precipitate occurred, and in the next experiment the alcohol-free liquid mixed with seven volumes of 95 per cent. alcohol was allowed to stand ten days and then filtered.

The precipitate and filtrate were treated as in the preceding experiments.

In Experiment No. 56 each of six fowls on white polished rice received in addition daily their proportion of the 83 per cent. alcohol—insoluble substances and cases of polyneuritis occurred.

In Experiment No. 57 each of six fowls on white polished rice received in addition daily their proportion of the 83 per cent. alcohol—soluble substances and cases of polyneuritis did not occur.

It was thus proved that the protective substances were soluble in 83 per cent. alcohol and were not inactivated by contact with alcohol of that strength for a period of ten days.

In order that the strength of the alcoholic mixture might be considerably increased and the volume of the mixture kept within working limits, absolute alcohol in place of 95 per cent. alcohol was employed in the next series of experiments. The procedure adopted was as follows:—

The proof spirit filtrate obtained from the 0.3 per cent. HCl solution prepared from 30 grm. of polishings and measuring from 650—660 c.c. was placed in an evaporating basin, 10.5 c.c. of normal solution of carbonate of soda was added, and the liquid evaporated at a temperature of 60° C. until the volume was reduced to 50 c.c. To this was added 600 c.c. of absolute alcohol, the mixture stirred, allowed to stand for two days and then filtered. By this method the mixture produced was one containing 91 per cent. of ethyl alcohol.

The precipitate weighed on the average 1 grm., and was therefore appreciably greater in amount than that obtained from a mixture containing 83 per cent. of alcohol. It was freed from alcohol by exposure to the air, and suspended in 180 c.c. of distilled water. This volume contained the substances in 30 grm. of polishings soluble in 0.3 per cent. HCl, soluble in proof spirit, and insoluble in 91 per cent. alcohol.

In Experiment No. 58, each of six fowls on white polished rice received in addition daily 30 c.c. of this suspension, and cases of polyneuritis occurred.

The 91 per cent. alcoholic filtrate was evaporated at a temperature of 60° C. until free of alcohol, the residue dissolved in distilled water and the volume adjusted to 180 c.c. This volume contained the substances in 30 grm. of polishings, soluble in 0.3 per cent. HCl, soluble in proof spirit, and soluble in 91 per cent. alcohol.

In Experiment No. 59 each of six fowls on white polished rice received in addition daily 30 c.c. of this yellowish turbid fluid, and cases of polyneuritis did not occur.

It was thus shown that the protective substances are soluble in 91 per cent. alcohol.

### Experiments with 91 per cent. Alcohol Filtrate.

Experiments were undertaken with a view to the isolation and testing of the various substances contained in the 91 per cent. alcoholic filtrate.

This filtrate was a clear yellowish liquid. In view of the fact that the protective substance or substances are destroyed by exposure to steam under pressure, it was considered probable that the activity of the liquid was not due to the presence of salts, but rather to the presence of some organic compound or compounds.

When the filtrate is freed from alcohol and the residue mixed with distilled water, a yellowish turbid liquid is obtained. This liquid, on satura-

tion with ammonium sulphate, yields a reddish-brown precipitate which gives the usual protein reactions. Half saturation with ammonium sulphate produces a slight precipitate. Saturation with sodium chloride produces a precipitate, and on filtration the filtrate saturated with ammonium sulphate gives a further precipitate.

As many vegetable globulins are not precipitated until their solutions are nearly saturated with ammonium sulphate, it cannot be inferred that the alcoholic filtrate contains both a globulin and albumin.

Unpolished rice was tested, and found to contain alcohol soluble proteins, while polished rice, similarly tested, was found to contain none. It would appear therefore that Rosenheim and Kajuira were in error in stating that rice did not contain alcohol-soluble proteins. It seems probable that they did not examine unhusked rice (padi), and unpolished rice, not being an article of commerce, would, of course, not be available.

The alcoholic filtrate freed from alcohol and the residue solved in distilled water was tested with Fehling's solution, and gave a precipitate of cuprous oxide. The solution was heated with phenylhydrazine hydrochlorate and sodium acetate; crystals of phenyl-glucosazone were obtained. Another portion of the liquid was saturated with ammonium sulphate and filtered; the filtrate was heated with phenylhydrazine hydrochlorate and sodium acetate, and crystals of phenyl-glucosazone were obtained.

The 91 per cent. alcoholic filtrate evaporated to dryness, and the residue, dried in a desiccator, was found to contain, after making allowance for the sodium chloride formed on partial neutralization with normal solution of sodium carbonate, total solids amounting to 14.2 per cent. of the sifted polishings. These solids form a brown, sticky, hygroscopic residue.

Gravimetrically it was determined that 2.9 grm. of glucose, and by the Kjeldahl process that 2.08 grm. of protein are contained in this 14.2 grm. of total solids. The remaining 9.22 grm. was assumed to be salts.

It was sought to isolate and test the value of the alcohol soluble proteins. For this purpose dialysis was tried, but the conditions here are unsuitable for dialysis, as, even with the addition of thymol, a mass of moulds and bacteria develop in a day or two, both in the dialyser and the water. Unfortunately we had not a porcelain filter suitable for attachment to the water supply, and eventually dialysis for the purpose of separating the alcohol-soluble proteins had to be abandoned.

It was decided to employ ammonium sulphate for the separation of these bodies, and the following procedure was adopted:—

The 91 per cent. alcoholic filtrate, representing the quantity obtained from 30 grm. of polishings, was evaporated at 60° C. till free from alcohol; the residue was dissolved in distilled water and the volume adjusted to 100 c.c. To this solution was added 72 grm. of ammonium sulphate, being the amount found by experiment to be necessary for saturation. The mixture was agitated until the salt was entirely dissolved, then filtered.

The reddish-brown precipitate obtained was solved in distilled water, and the volume adjusted to 180 c.c. This volume contained the substances in 30 grm. of polishings, soluble in 0.3 per cent. HCl, soluble in proof spirit, soluble in 91 per cent. alcohol, and precipitated by saturation of the latter solution freed from alcohol with ammonium sulphate. The yellowish fluid obtained was a solution of the alcohol-soluble proteins in a dilute solution of ammonium sulphate. The fact that the proteins were soluble in this fluid suggests that they were not denatured.

In experiment No. 60 each of six fowls on white polished rice received in addition daily 30 c.c. of this solution. It was calculated experimentally that each fowl received daily not more than 0.5 grm. of ammonium sulphate. All the fowls lost weight, and one case of polyneuritis, showing marked degenerative nerve-changes, occurred in the fourth week.

The filtrate, obtained after saturation of the protein-containing solution, was useless for feeding experiments, because it was saturated with ammonium sulphate. This filtrate, after standing a few days, showed a deposit of crystals which on examination were found to be magnesium sulphate.

This filtrate, freed from proteins, and assuming that it contained only sugar and salts, ought to be completely dialysable.

It was thought probable that this process might more readily be carried out on the protein-free fluid; but even in the case of this fluid, after two days' dialysis in running water, the outside of the parchment paper was covered with a slime of micro-organisms. The addition of thymol to the contents of the dialyser prevented growths occurring inside the dialyser, but thymol in the water did not prevent the growth on the outside.

Dialysis was only possible by the following procedure: The protein-free filtrate was placed in the dialyser along with a piece of thymol; after two days' dialysis in running water the fluid was heated on a water bath, the parchment paper renewed, and the fluid dialysed for another two days. It was heated again, the paper renewed, and a further two days' dialysis carried out. It was then heated and dialysed into distilled water changed daily for six days. The fluid remaining after dialysis for twelve days was evaporated to dryness, and a slight residue of a yellowish colour was obtained.

The residue weighed 0.02 grm.; it was soluble in water, and partly organic. It amounted to not more than 0.02 per cent. of the solids contained in the fluid dialysed.

It was observed that the fowls fed on white rice, *plus* the alcohol-soluble proteins, lost weight, and it was considered possible that part of these substances might have been lost in the course of

various manipulations to which the fluid had been subjected. On account of the large quantities of absolute alcohol required, it was not possible to prepare the alcohol-soluble proteins in such quantities as to enable us to give each fowl daily the amount obtained from 10 grm. of polishings. It appeared simpler to employ the original proof spirit filtrate. It may here be remarked that the active substances are unchanged by contact for months with proof spirit. In this experiment the procedure adopted was as follows:—

The proof-spirit filtrate in quantities representing the materials from 30 grm. of polishings dissolved out by 0.3 per cent. HCl, soluble in proof spirit and measuring usually from 650 to 660 c.c., was placed in glass evaporating basins. To each lot 10.5 c.c. of normal solution of carbonate of soda was added, and evaporation carried out at 60° C.

The alcohol-free fluid obtained from each lot was made up to 100 c.c. with distilled water saturated with 72 grm. of ammonium sulphate and filtered.

The precipitate was dissolved in distilled water, and the volume adjusted to 180 c.c. This contained the substances in 30 grm. of polishings, dissolved out by 0.3 per cent. HCl, soluble in proof spirit, and precipitated by ammonium sulphate.

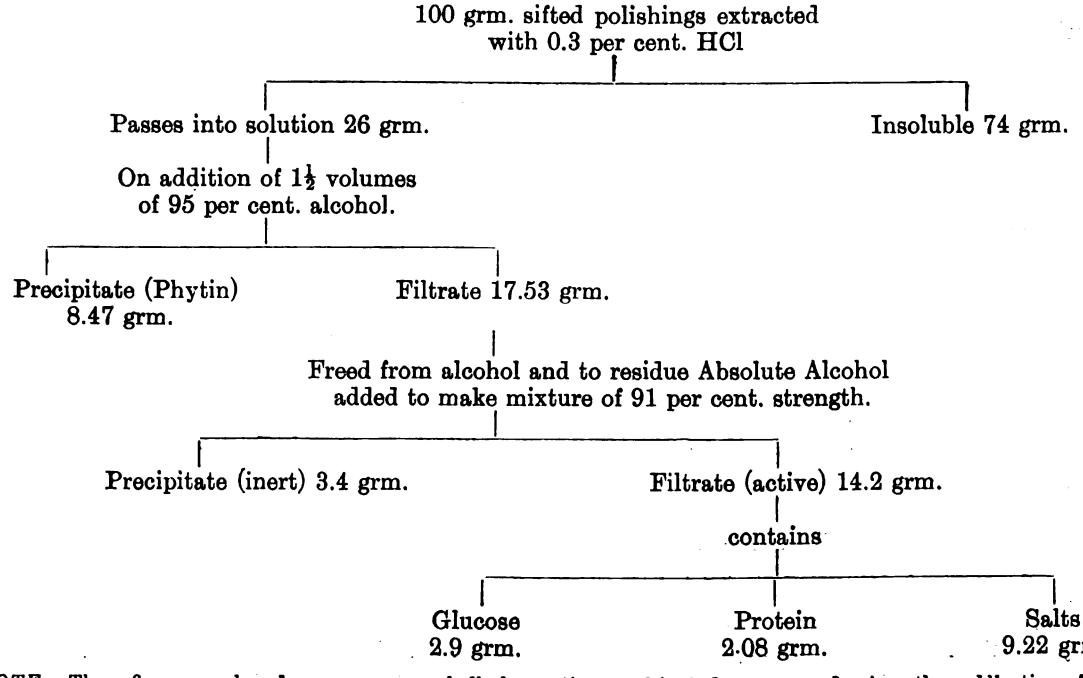
In Experiment No. 61 each of six fowls on white polished rice received in addition daily 30 c.c. of this solution. At the end of one week all but one had lost weight, and it was decided to give them an additional 30 c.c. daily, the second dose being given half an hour after they had received the afternoon meal. Even with this increased amount the fowls continued to lose weight, and at the close of the fourth week one case of what appeared to be polyneuritis occurred, but examination of the nerves failed to reveal the presence of degenerative changes.

The experiment was continued for thirty-one days, and on the thirtieth day another similar case occurred, but again there were no degenerative changes in the nerves.

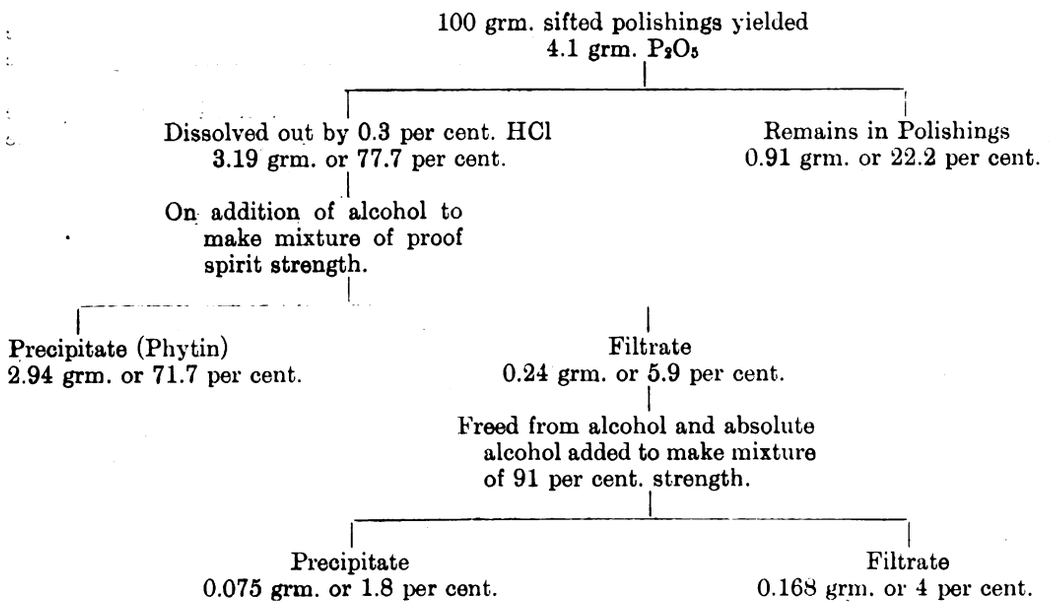
It must therefore be concluded that the alcohol-soluble proteins are not by themselves sufficient to protect fowls fed on white rice from the occurrence of polyneuritis. This conclusion is based on the assumption that the alcohol-soluble proteins were unchanged by the treatment to which they had been subjected.

In previous experiments it has been shown that the protective substances are extracted from parboiled rice by the use of hot 94 per cent. alcohol. It was thought possible that, as polishings are in a much finer state of sub-division, agitation with 95 per cent. alcohol might suffice to extract the protective substances and not the protein, but even by this process both protein and glucose were extracted; a similar result was obtained with absolute alcohol. Experiments are now being undertaken to determine if the protective substance or substances can be separated from the ammonium sulphate filtrate or from the polishings by the use of other solvents, as, for example, ethyl acetate.

It may be that the 91 per cent. alcoholic filtrate contains substances other than proteins, glucose, and salts, but until such time as the various constituents of that filtrate have been isolated, tested and identified, the biological reaction remains the only method by which the presence of the protective substances can be detected.


100 grm. sifted polishings extracted with 0.3 per cent. HCl
Passes into solution 26 grm.
Insoluble 74 grm.
On addition of 1½ volumes of 95 per cent. alcohol.
Precipitate (Phytin) 8.47 grm.
Filtrate 17.53 grm.
Freed from alcohol and to residue Absolute Alcohol added to make mixture of 91 per cent. strength.
Precipitate (inert) 3.4 grm.
Filtrate (active) 14.2 grm.
contains
Glucose 2.9 grm.
Protein 2.08 grm.
Salts 9.22 grm.

*NOTE.*—These figures are based on an average of all observations and include many made since the publication of a paper in the *Lancet*, No. 4555, of December 17, 1910. They differ to a slight extent from those recorded in that paper.


100 grm. sifted polishings yielded
4.1 grm. $P_2O_5$
Dissolved out by 0.3 per cent. HCl
3.19 grm. or 77.7 per cent.
Remains in Polishings
0.91 grm. or 22.2 per cent.
On addition of alcohol to make mixture of proof spirit strength.
Precipitate (Phytin)
2.94 grm. or 71.7 per cent.
Filtrate
0.24 grm. or 5.9 per cent.
Freed from alcohol and absolute alcohol added to make mixture of 91 per cent. strength.
Precipitate
0.075 grm. or 1.8 per cent.
Filtrate
0.168 grm. or 4 per cent.

| | Effect on fowls; estimated by the occurrence of polyneuritis. | Estimated amount in grm. of fat in diet. | Estimated amount in grm. of $P_2O_5$ in diet. |
|---|---|---|---|
| Unpolished rice | — | 0.99 | 0.336 |
| Polished rice plus polishings | — | 0.83 | 0.357 |
| Polished rice | + | 0.13 | 0.156 |
| Washed polished rice | + | 0.13 | 0.126 |
| Washed polished rice plus fat-free polishings | — | 0.16 | 0.326 |
| Washed polished rice plus polishings | — | 0.83 | 0.331 |
| **Polishings extracted with 0.3 per cent. HCl.** | | | |
| Washed polished rice plus extracted polishings | + | 0.83 | 0.165 |
| Washed polished rice plus extract | — | 0.13 | 0.281 |
| **Extract mixed with one and a half times its volume of 95 per cent. Alcohol.** | | | |
| Washed polished rice plus precipitate | + | 0.13 | 0.27 |
| Washed polished rice plus filtrate | — | 0.13 | 0.138 |
| **Filtrate freed from alcohol and absolute alcohol added to residue to make mixture of 91 per cent. strength.** | | | |
| Washed polished rice plus precipitate | + | 0.13 | 0.129 |
| Washed polished rice plus filtrate | — | 0.13 | 0.133 |

## Conclusions.

(1) The occurrence of beri-beri in the Malay Peninsula has an intimate relationship with the consumption of a diet of which white polished rice forms the staple. Those who consume unpolished rice or slightly polished (native or Malay or parboiled) rice do not suffer from the disease.

(2) Fowls fed on white polished rice known to have been associated with outbreaks of human beri-beri develop a form of polyneuritis clearly analogous to beri-beri in its clinical manifestations and pathological effects. Other white polished rices produce a similar result. Fowls fed on unpolished rice remain healthy.

These animals may therefore be employed to study the mode of operation by which a diet of white polished rice results in beri-beri in man.

(3) The estimation in terms of phosphorus pentoxide of the total phosphorus content of a given rice may be used as an indicator of the extent to which such a rice has been milled or polished, and therefore of its beri-beri-producing power when forming the staple of a diet in man.

(4) The harmful influence of white polished rice is not due to the existence in it of a poison developed after milling. White polished rice makes default in respect of some substance of high physiological importance essential for the maintenance of health.

(5) Fowls fed on white polished rice constantly develop polyneuritis in a period of three to four weeks.

(6) If the meal or polishings removed from such white rice in the process of milling be added to a diet of white polished rice, fowls remain healthy.

Substances essential for the maintenance of health are therefore contained in polishings.

(7) Unpolished rice which has been submitted to sterilization in the autoclave at a temperature of 120° C. for two hours will cause polyneuritis when fed to fowls. The protective substances are destroyed under these conditions.

Methods of analysis involving exposure to high temperatures are therefore unsuitable for determining the nature of the protective substances.

(8) The fats contained in the peripheral layers of the grain are of no value in protecting against polyneuritis.

(9) The protective substances are soluble in 0.3 per cent. hydrochloric acid.

Phytin, which comprises 32.5 per cent. of the substances so soluble, is without value as a protective.

(10) The substances are not precipitated from solution in 0.3 per cent. hydrochloric acid on the addition of 95 per cent. alcohol in such quantity as to make the resulting mixture of proof spirit strength.

They are soluble in proof spirit containing approximately 0.12 per cent. hydrochloric acid.

(11) The protective substances are soluble in a slightly acidulated solution containing 91 per cent. of alcohol, and, exclusive of glucose, amount to not more than 11.3 per cent. by weight of rice polishings and not more than 1.13 per cent. of the original unpolished rice grain. In this fraction are included prolamine (alcohol soluble protein) and compounds of calcium, magnesium, and phosphorus.

These researches, which comprise an unbroken sequence of experiments beginning with rices associated with outbreaks of human beri-beri, demonstrate that rice is rendered harmful by the milling and polishing process to which it is subjected in the preparation of white polished rice. In this process there is removed from the grain some substance of high physiological importance in the metabolism, the absence of which results in the production of polyneuritis in fowls and of beri-beri in man when a diet is consumed of which white polished rice is the staple. Whether these substances act by rendering other elements in the diet available for nutrition, or whether they are themselves the nutritive material necessary for nerve tissues, can in our present state of knowledge only be matter for conjecture. These substances, small in amount as compared with the total of the diet, have been determined within certain narrow limits, but their exact chemical nature is still unknown.

There is no evidence that white rice contains a poison generated after decortication by the action of moulds or other organisms.

As measures for the prevention of beri-beri in this country, it is recommended that the use of unpolished or under-milled rice be encouraged among those classes of the community in which the disease occurs. The polishing process, if carried out at all, should not extend beyond the removal of the outer skin or pericarp. The parboiling of rice before milling, as recommended by Dr. Braddon, serves the important purpose of so hardening the outer layers of the grain that their removal is less easy and over-milling is less likely to occur. The cooking of rice by steam under pressure should be prohibited. As an indicator of the extent to which rice has been milled, we recommend to chemists the use of the phosphorus pentoxide standard. In the examination of a large number of rices, none were found associated with human beri-beri or polyneuritis in fowls which yielded a phosphorus pentoxide content of 0.4 per cent. or over, as estimated on the undried material. The amount of moisture varied only slightly, and none of the rices were faced.

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*Amœbic Colitis.*—Deeks and Shaw, of the Ancon Hospital, Panama, at the eighth annual meeting of the American Society of Tropical Medicine, held in New Orleans, May 18 and 19, 1911, read a paper on amœbic dysentery. The treatment they recommend is: Absolute rest; absolute milk diet, of which there should be an abundance; saline or water irrigations; and bismuth subnitrate in heroic doses. In addition, the authors do not object at the beginning, if tenesmus and distress be very severe, to an occasional hypodermic of morphine and atropine, but as a routine measure it is not considered good treatment. This bismuth treatment is, of course, an old one, but its advocates in India and other British Possessions have greatly diminished of late. The authors' remarks on ipecacuanha can only be described as extraordinary. Here they are:—

"The standard treatment in most countries is that of ipecac by mouth. It has its advocates here on the Isthmus, and is in use in Colon Hospital. We have never used it in Ancon Hospital for the reason that, in the first place, the present method in vogue has given us eminently satisfactory results, and, secondly, the physiological action of the active principle of ipecac is unknown, and if it cures amœbic colitis in the dosage and after the manner described by its advocates, it must be tremendously bactericidal and amœbicidal, else how can we explain such miraculous cures with a few ipecac pills, coated or not, with salol, which frequently pass through the bowel undissolved. The method has never appealed to our physiological common sense, and for that reason we have not even tried it."

"Where ignorance is bliss, 'tis folly to be wise," but really one expects a little more than this from two physicians of the Ancon Hospital, a tropical hospital through which large numbers of cases must annually pass. To condemn a treatment which is universal throughout India and other parts of the Tropics, and that even without ever having tried it, is, to say the least of it, strange.

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THE JOURNAL OF

# Tropical Medicine and Hygiene

DECEMBER 15, 1911.

## RECENT PELLAGRA INVESTIGATIONS BY THE BRITISH PELLAGRA COMMISSION.

A MEETING of the Pellagra Investigation Committee was held on December 12, 1911, in London, for the purpose of receiving an interim report of the recent investigations carried out in Roumania, Hungary, Austria, Italy, Spain and France, by a field Commission consisting of Dr. L. Sambon (Parasitologist on the staff of the Wellcome Physiological Research Laboratories) and Dr. A. J. Chalmers, as a continuation of a previous field Commission composed of Dr. Sambon, Captain Siler, and Dr. Lavinder, who worked in Italy in 1910. Sir Patrick Manson presided, and there was a large attendance.

The field Commission found that the importance of pellagra was still little appreciated in many countries, and was probably much under-estimated. In Roumania alone at the present time it is calculated that the cases number over 200,000. The Commission could find no evidence in support of the maize theory of the disease, which theory appears, *ab initio*, to be of Italian origin. On the contrary, the Commission found statements intended to support that theory and to be opposed to the *Simulium* theory to be erroneous. For

example, in Bucharest, it was stated that in a neighbouring village inhabited by Roumanians and Bulgarians, the former ate maize and suffered from pellagra, whilst the latter did not eat maize and did not suffer from pellagra; but this fable was easily dispelled by a visit to the village, where the local doctor produced no less than twenty Bulgarian pellagrines. Such statements are apt to find their place in literature as facts, and are therefore of a most misleading nature.

In all the countries visited the endemic foci of the pellagra were found to be remarkably persistent—that is to say, the disease has remained in the same localities where it was first recognised. It is true that it fluctuates in amount and severity in different years and in different series of years, and this fluctuation appears to be associated with œcological conditions more or less favourable to it; for example, presence or absence of excessive rainfall, &c.

In some places it has apparently greatly diminished, and this diminution appears to be associated with great artificial changes in the environment brought about by the action of men; for example, extensive cultivation, the regulation of rivers, preventing inundations, the introduction of fish and the pollution of rivers by industrial products. Thus, the almost entire disappearance of pellagra in the French Landes appears to be associated with the above-mentioned factors, and it is striking, from the point of view of the *Simulium* theory of pellagra, that malaria has likewise almost disappeared from the same region at the same time.

The endemic foci were found to be associated with the presence of flowing streams, in whose waters the larvæ and pupæ of various species of the genus *Simulium* were found, and on whose banks the fly could also be found; and, moreover, it was noted that sometimes the worst part of an endemic area was that adjoining the stream. For example, in houses adjoining streams containing numerous larvæ and pupæ all the members of the family were often found to be suffering from the disease.

With regard to the valley of the Nora, in the Province of Oviedo, in North Spain, the local physicians stated that the disease was only to be found in an area not exceeding three kilometres on either side of the river.

In studying the topographical distribution of a disease of the nature of pellagra, it is necessary to remember that, owing to the usual long duration of the affection and the possible movement of individuals, a case may be recognised when residing far from the original source of infection.

The best index for the recognition of the endemicity of pellagra as of malaria, is its presence in very young children who have never moved from the locality.

Pellagra, however, is often mild in young children and frequently overlooked. Another point also to be borne in mind is the necessity of studying the disease as seen in its endemic foci, and not merely as seen in hospitals and asylums. If this is not undertaken, no correct idea as to the *fons et origo* of the complaint is possible.

The diagnosis is at times difficult, and the individual equation comes largely into play. This explains why in some places the number of cases appears to be exaggerated whilst in others it is under-estimated. This fact is realized in certain countries; for example, in Hungary the personal equation is limited, as the investigations are controlled by one expert, whilst in Spain the futility of pellagrous statistics collected in an ordinary manner is so clearly recognised that they are not now kept, and this is possibly better than publishing erroneous and misleading data. In several places where pellagra was believed by the local authorities to be absent, typical cases, especially in children, were readily discovered.

Popular beliefs with regard to pellagra, as well as other diseases, are not to be despised. Thus the Commission found that in the Oviedo district of Spain the inhabitants believe that the disease is contracted in the early morning and evening from the mist that arises in the neighbourhood of streams—a credence remarkably similar to the popular belief concerning malaria. Another belief found amongst certain Roumanian peasants is that the recurrence of the erythema in old cases takes place at the same season of the year as that in which the new grass appears (about the end of March), whilst the erythema of the new cases does not appear until May or even June, is also interesting with regard to the possible transmission of the disease by an insect carrier.

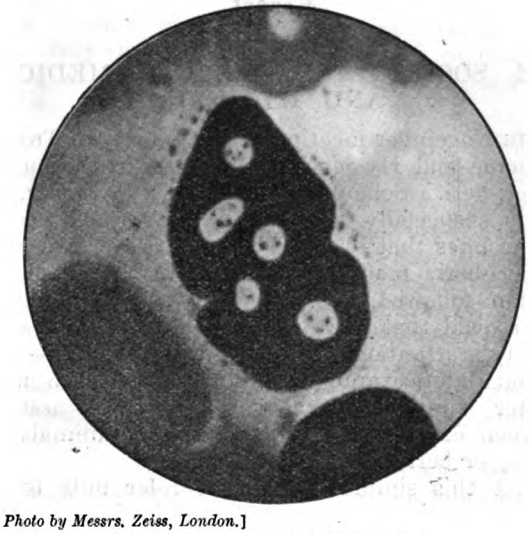

*Photo by Messrs. Zeiss, London.*]

**Magnification, 2,000 diameters.**

Although the work of the Commission was intended to be solely epidemiological, still, any opportunity for microscopical or experimental work was eagerly seized. Thus, species of *Simulium* were caught, reared and dissected; the cerebro-spinal fluid of pellagrines was also examined. In Roumania an early *post mortem* was performed on the body of a young woman who had suffered

from pellagra for two years, and who, very recently, had had a recurrence of the erythema on the hands, feet and neck, associated with other symptoms of the disease. One of the results of these investigations was the finding of peculiar bodies shown in the attached micro-photograph. These bodies appear to be invariably located in nuclear material, and were found in the liquor cerebro-spinalis, in smears from the sensorio-motor cortex and from a blood clot lying in contact with, and posterior to, the lower cervical and upper dorsal regions of the spinal cord.

The Committee approved of the lines on which the work had been conducted, and made plans for immediate future work. It accorded a most hearty vote of thanks to Mr. Henry S. Wellcome for his exceedingly kind assistance and for his constant support, whereby the work was enabled to be carried on. The Committee also gratefully accorded its thanks to the Governments of Roumania, Hungary, Austria and Spain for the great assistance rendered by them to the Commission, and also to Dr. Hugo Höllander, of the Hungarian Medical Service; Professor W. Babes, of Bucharest; Drs. Lupu and Vasilu, of the Roumanian Medical Service; Dr. Weiss, of the Austrian Medical Service; the Mayor of Feltre; Dr. Ferrari, of Feltre; Professor Pittalugi, of Madrid; Drs. Valdes Magnet and Farandeses, of Oviedo; Professor Dancen; Drs. Hameau and Dartigolles, of Bordeaux, for their kind co-operation and help.

## Report.

### THE SOCIETY OF TROPICAL MEDICINE AND HYGIENE.

THE November meeting of the Society of Tropical Medicine and Hygiene was devoted to the subject of beri-beri. Schaumann, Axel Holst, Fraser, and others, especially those who have been working on the lines that overpolished rice is the real cause of beri-beri, read papers, and an animated discussion followed. Schaumann, in concluding his paper, said that finally he would like to draw the Society's attention to the following points:—

That later examinations had shown the much greater similarity than one formerly assumed between experimental polyneuritis of animals and kakke, or beri-beri.

That this similarity did not refer only to the etiology, as far as it was connected with the nutrition, but also to the pathologic anatomical alterations due to both diseases.

That therefore there seemed to exist many more reasons for assuming that both diseases were identical than to presume the contrary, chiefly by taking into consideration that the same cause must not necessarily have the same results in different organisms.

That the extraordinary success obtained by Fletcher, Fraser, Ellis, and particularly by Heiser in the Philippines, solely by a change in the diet, could reasonably only be attributed to the change in the nutrition. There could be no question that the essential factor lay in the giving of the rice-bran adhering to the cured rice.

Further, as many reports showed, the same result could, however, be attained by the addition of other food to polished rice, and therefore it was not an exclusive property. For instances, peas, *Phascolus radiatus*, and fresh meat might be mentioned. The activator itself and the organic phosphorus compounds rendered fit for use by it were most likely contained in many articles of food, even though in very varying quantities.

That the assumption that beri-beri was a metabolic disease was favoured by the circumstance that there was not a single infectious disease which could be prevented exclusively by a change in diet, and which could be cured by such a change.

He said, however, that it was far from him to completely exclude biological processes in the etiology of beri-beri, although it seemed to him that alimentary influences greatly predominated. It was not improbable that an abnormal flora and other parasites of the intestines might destroy the activator as well as the phosphorus compounds in question. The intestinal parasites might likewise injure the mucous membrane of the intestines, by which resorption could be hindered.

The effect must, then, naturally be the same as with an insufficient supply of the mentioned effective substances, and could therefore easily cause the illusion of an infection.

All the effects taken together seemed to him, however, only to allow of one conclusion—that beri-beri was a disease due to deficient metabolism of phosphorus and its consequences.

Axel Holst, speaking especially of beri-beri as seen on board ships (ship beri-beri), said that, though the disease had relationship to scurvy, yet there existed, on the other hand, some facts speaking against such a contention. It was true, Dr. Frölich and himself had found that the anti-scorbutic constituents, for instance, of fresh cabbage were, to some extent, soluble in acids, but not in petrol-ether, and that they dialysed. These reactions agreed with some of the results found by Fraser and Stanton and Shiga and Kusama, with regard to the anti-neuritic compounds of the polishings of rice. Dr. Frölich's and his own chemical researches were, however, not far advanced, and this was due to the fact that the anti-scorbutic constituents of fresh vegetables suffered from a far greater fragility than the corresponding anti-neuritic substances hitherto studied. This represented a great difference indeed. For instance, if you dried fresh cabbage and kept it in an open vessel in your laboratory-room, it lost, within some months, its anti-scorbutic properties. It was easy to show that this was due to the humidity in the air. On the other hand, however, even if rye-flour was exposed for two years to a moist air, it did not

produce neuritis when given to pigeons. This seemed to prove that the anti-neuritic constituent of the rye-flour was not destroyed by humidity. He added, however, that the polishings of rice, being excellent protective remedies against the experimental neuritis of poultry, did not prevent the experimental scurvy of guinea-pigs; but still you might make peas prevent the latter disease, as Dr. Fürst in Christiania had proved. The peas prevented the experimental scurvy when they were moistened and made to sprout. That was, they must be converted to a fresh vegetable. These preventive properties were not destroyed if the peas were boiled for one hour at 100° C. The same applied to grains, such as oats and barley; if guinea-pigs were fed on these nutriments before sprouting, they died from scurvy; if after sprouting, they did not get ill.

Under these circumstances, Holst thought it might be of interest to examine the bone-system from *post mortems* of beri-beri cases in order to ascertain if there possibly existed some of the peculiar changes of the bone-marrow specific to scurvy. Dr. Frölich and himself had also tried to carry out investigations of this kind, Dr. Vis, of Java, having been good enough to send them several ribs from each of about thirty *post mortems* of beri-beri cases in Java. No changes of the said nature were found, however.

Under all the circumstances, Dr. Frölich and himself thought it safer to limit themselves to a neuter expression, and to imagine that there must exist, somewhere, a bridge between beri-beri and scurvy; but they could not tell if there existed a real relationship. When, for instance, fresh cabbage prevented both the experimental neuritis and the experimental scurvy, the explanation possibly would be this—that the cabbage contained two different compounds, the former preventing one and the latter the other disease.

Dr. Fraser, who followed, supported the views he and Stanton had already expressed in their work on the etiology of beri-beri (*vide* the JOURNAL OF TROPICAL MEDICINE AND HYGIENE, November 15, 1911, and following numbers). He disagreed with Schaumann that phosphorus played any part in the production of the disease. Other speakers who followed dealt chiefly with the possible nature of the substance present in the under-layers of the rice, the presence of which prevented the production of the disease. What this is is yet unknown, but probably chemists will ultimately discover its true nature.

### "Indian Medical Gazette," November, 1911.

*Leprosy.*—Premananda Das contributes some notes on the "Nastin" treatment of leprosy. After a trial of the remedy he has come to the conclusion in his own mind that "Nastin" acts energetically on the leprous nodules, producing softening and dissolution of the nodules. He further believes that "Nastin" prepares the lepra bacilli for bacteriolysis, whilst Chaulmugra oil produces leucocytosis, which helps bacteriolysis.

## Annotations.

*Salvarsan in the Treatment of Syphilis.*—In the *New York Medical Journal* for October 21, 1911, Lydston, of Chicago, contributes a paper entitled "A Brief on the Salvarsan Treatment of Syphilis." After a careful and open-minded review of the subject up to date, he concludes, whatever the experience of others, that, at the present writing, salvarsan has greatly increased our resources in the therapy of syphilis, and that it is in general our most valuable emergency and symptomatic remedy for syphilis. As to how far it can be trusted for permanent results, time alone will show. He confesses that, while he is in a decidedly receptive attitude toward the drug, his scepticism grows with increasing experience. That mercury intelligently given is the proper follow-up system to clinch the good done by salvarsan and on its own merits to bring about a permanent cure seems obvious. Personally, he inclines to the belief that our experience with salvarsan has not yet arrived at a point where the drug can be relied upon to the exclusion of mercury and iodides. In thus relying upon salvarsan he believes that we do not do our full professional duty.

It has been his experience that where salvarsan alone is relied upon, and the infection is brought under control, relapses are more frequent and earlier than where the case has been controlled by mercury alone. It is to be remembered, however, that certain cases are either resistant to or intolerant of mercury, and that salvarsan is in these cases a *sine quâ non*.

This résumé of Lydston's is interesting, and shows very fairly how the trend of opinion is steering as regards salvarsan in the treatment of syphilis.

*Gastro-enterostomy for Gastric and Duodenal Ulcer.*—Mr. Leonard Bidwell, in a very interesting paper entitled "Immediate and Ultimate Results of Gastro-enterostomy for Gastric and Duodenal Ulcer," published in the *West London Medical Journal* for October, 1911 (vol. xvi, No. 4), gives, as the result of his extensive experiences of this operation, the following conclusions. These seem so important that we quote them *in extenso* as tropical readers may experience some difficulty in consulting the paper in the original:—

(1) That the operation of simple gastro-enterostomy is practically certain to be followed by permanent success in all the cases where there is cicatricial contraction of the pylorus or in cases of hour-glass stomach.

(2) In the case of an ulcer situated either just above or below the pylorus, the operation of gastro-enterostomy combined with occlusion or division of the pylorus is likely to be completely successful. The greater number of cases of pyloric ulcer are placed in the first group after operation.

(3) When the ulcer is situated in the stomach at

any distance from the pylorus, the operation of gastro-enterostomy by itself, even though combined with occlusion of the pylorus, is practically useless, and excision of the ulcer must be undertaken at the same time. Neglect of this rule accounts for many recurrences.

(4) The performance of gastro-enterostomy on patients who are suffering from hyperchlorhydria producing spasm of the pylorus, and when there is not any ulcer in the stomach or duodenum, is not only unnecessary, but is often harmful and leaves the patient in a worse position than before. Such cases are nearly always subjects of marked neurosis.

(5) That duodenal ulcer is not often permanently cured by medical means, and, moreover, is likely to prove fatal sooner or later, either by profuse hæmorrhage, by perforation, or by producing cicatricial contraction. It should be a rule to operate on all cases of duodenal ulcer in which the condition can be diagnosed, and it must be an invariable practice to combine the operation with occlusion of the pylorus.

(6) In cases of gastric or duodenal ulcer where only one severe hæmorrhage has occurred, it is best to wait for some weeks before operating, and when gastro-enterostomy is performed, the ulcer itself must also be treated either by excision, ligature, or pressure. When, however, repeated hæmorrhages occur, an operation has to be undertaken at once to save life. It must, however, be borne in mind that an operation performed on a very anæmic patient is not devoid of risk. The prognosis without operation is probably more unfavourable. The operation of gastro-enterostomy should be performed in all cases in order to put the stomach at rest. When the ulcer is situated on the stomach away from the pylorus it should be excised. When situated on the posterior surface and adherent to the pancreas, a purse-string ligature should be passed all round its edge and tied tightly; when the ulcer is situated on the posterior surface of the duodenum, recurrence of bleeding can be prevented by the invagination of the wall of the duodenum to form a pad which presses upon the ulcer.

(7) In cases of rupture of a gastric or duodenal ulcer, in which an operation is done within a few hours of perforation, gastro-enterostomy should be performed after the perforation has been closed, as not only does the anastomosis provide against any dilatation of the stomach and tension on the sutures closing the perforation, but it also prevents the cicatricial contraction which is certain to occur if the ulcer be in the neighbourhood of the pylorus.

Of 181 cases on which Mr. Bidwell operated, ninety-three were cases of gastric ulcer; twenty-two of these were males and seventy-one were females. In twenty-nine cases the ulcer was in the pyloric region; of these sixteen were males and thirteen were females. In fifty-nine cases the ulcer was in the duodenum; of these thirty-eight were males and twenty-one were females. This corresponds very closely with the general ideas of gastric and duodenal ulcers. It shows that the gastric ulcer is three times as common in females as in males. The duodenal ulcer is twice as common in males as in females, and pyloric is nearly equally common in the two sexes. The general incidence of ulcer sufficiently severe to necessitate operation is not so very different in the two sexes, being 105 in females and seventy-six in males.

In conclusion, Mr. Bidwell thinks that the operative treatment of gastric and duodenal ulcer has a lower mortality than treatment by medical means, as even in a series of unselected and complicated cases it was about 7 per cent. He has also shown that operation effects a complete cure in over 70 per cent. of all cases, and in about 15 per cent. there is a varying amount of improvement and only about 5 per cent. are failures. When the brilliant results of the successful cases are considered and compared with the results of medical treatment, Mr. Bidwell believes that one should not hesitate to recommend operation in every case where a duodenal ulcer has been clearly diagnosed, or a gastric ulcer has not been cured by medical means.

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*Black Mycetoma.*—Chatterjee, writing in the *Indian Medical Gazette* for October, 1911, on the biology of black mycetoma, states that Brumpt has described two varieties of black mycetoma, the one studied by Bouffard, which he describes as *Asperigillus bouffardi*, the other the *Madurella mycetoma*, a parasite similar, apparently, to the Indian variety. Chatterjee now believes that he has himself cultivated the fungus of the black mycetoma from a case of this disease admitted into the Medical College Hospital, Calcutta. A piece of tissue was removed from a globular swelling of about the size of an orange situated in the plantar surface of the leg. On making a section through the piece, numerous small black grains about the size of a pin's head were found situated in small cavities in the tissue. These were loosely attached and could be easily removed. A large number of these grains were removed under sterile precautions in various culture-media; some were kept for examination and the rest of the tissue kept for section.

Some of the grains were crushed between two slides and smears were made and were examined under the microscope, both stained and unstained. Smears showed numerous branching blackish threads with septa. They were very coarse. Stained films showed the same black threads which did not take any stain; no spores were found.

For purposes of cultivation some of the grains were placed under strict aseptic precautions in ordinary agar and also in glucose-agar tubes. Next day, the surfaces of the cultures were found uncontaminated with any organism. The grains appeared as if increased in size. By the fourth day there was no doubt about the increase in size of the grains. They had become seven to eight times their former size and were surrounded by a fine hair-like structure. Smears examined from the surface of the cultures showed delicate branching mycelial

threads which took the stain very easily and showed a nucleus-like structure inside the threads. This appearance was quite unlike the thick black threads found in the grains.

Cultivations in different culture-media, potato, bouillon, milk, Sabouraud's culture-medium, besides sugar solutions were tried. In potato the growth was dry and black, not a drop of moisture was found. In bouillon, a peculiar appearance was seen. If a piece of old black growth from agar was placed in the bouillon and then the tube thoroughly shaken, and incubated, numerous small white colonies were found with radiating rays, and all of them sticking to the glass wall. No diffuse growth was seen nor any scum on the surface. Animal experiment gave negative results.

*The Health of the Isthmian Canal.*—In his monthly report for the month of July, 1911, on the Department of the Isthmian Canal Commission, Colonel Gorgas states that the total number of deaths from all causes among employees was 56. Of these 41 were from disease, 15 from violence, giving the annual average per 1,000 of 10.29, and 3.77 respectively. The principal causes of death were: nephritis 5; lobar pneumonia, 10; hæmoglobinuric fever, 1; malarial fever (malignant), 8; tuberculosis, 4; typhoid fever, 2. During the month he further states that 39 cases of diphtheria were reported, 20 from the Canal Zone, 15 from Panama, and 4 from Colon with 4 deaths. The type of the disease, generally speaking, was mild, many of the cases being diagnosed by bacteriological examinations alone, the throat symptoms only indicating a very mild pharyngitis—the deaths were principally from laryngeal diphtheria in very young children.

One case of bubonic plague was taken from the S.S. "Guatemala," of the Pacific Steam Navigation Co., at the quarantine station, Culebra Island, on July 24, and the patient is recovering. This person had lived on shore at Callao four days prior to his embarkation, and probably contracted the infection during that time, as he was taken sick two days later.

No cases of yellow fever, smallpox, or plague originated on the Isthmus during the month.

## Notes and News.

*Unusual Weather in South Africa.*—East Transvaal has provided an extremely interesting meteorological phenomenon during the month of September. In the first week, quite winter conditions were experienced, with eight and ten degrees of frost every night. A fortnight later the hottest summer conditions prevailed, and the thermometer rose to between 89° and 92° in the shade, day after day, and the nights proved correspondingly close and hot. Statistics showed that the month produced the highest mean maximum shade temperature (80°), and the lowest mean maximum temperature (40.8°), recorded in ten years. Another strange occurrence was the total absence of rain, which, likewise, has never happened during a similar period.

International Institute of Agriculture.—The *Bulletin of Agricultural Statistics* for September has just been issued, under the direction of Professor Umberto Ricci, by the International Institute of Agriculture.

The Bulletin contains the most recent official data received at the Institute from the various countries in regard to the production of the cereal crops in the Northern Hemisphere. The production of wheat for the present year, in the group of countries included in the *Bulletin*, which represent about four-fifths of the world's total wheat production, is estimated at 829,782,823 quintals as compared with a production of 825,959,642 quintals last year. The Single Numerical Statement, *i.e.*, the ratio in percentage figures between the estimated production this year and the production obtained last year, is 100.5. The production for the present year supersedes that of the past year in Spain (42,600,000 quintals as compared with 37,400,000 quintals), Great Britain and Ireland (17,400,000 quintals as compared with 15,400,000 quintals), Hungary (52,400,000 quintals as compared with 49,400,000 quintals), Italy (52,300,000 quintals as compared with 41,700,000 quintals), and India (100,800,000 quintals as compared with 97,400,000 quintals). The production of wheat is smaller this year as compared with last year's production in Prussia (23,500,000 quintals as compared with 24,800,000 quintals), Roumania (26,000,000 quintals as compared with 30,200,000 quintals), Russia in Europe (150,900,000 quintals as compared with 190,300,000 quintals) and in the United States (179,200,000 as compared with 189,300,000 quintals.

For the other cereals, the single numerical statement for the countries considered is: for rye 96.4; barley 99.5; oats 88.9; and maize 86.6.

The two countries which, due to their poor harvests, have principally contributed to the fall in the figures of the single numerical statement are the United States and Russia.

The *Bulletin* also contains information as to the condition of the cotton crop, which in the United States and Japan promises about an average harvest, and in Egypt an outturn about 9 per cent. below the average.

Of especial interest is a comparison which has been made between the estimates of the present year's wheat production, as published by certain influential private periodicals, and the official figures published by the Institute. The differences brought to light by this comparison, and which in several instances are very considerable, illustrate the utility of the work accomplished by the Institute in thus exercising a control upon the large number of harvest estimates which are placed before the public, by furnishing, in one synthetic report, the official figures of production for the whole world.

## Drugs and Appliances.

GAS SUPPLY FOR SCIENCE LABORATORIES.—Mansfield and Sons, Ltd., of Birkenhead, have devised an apparatus, the object of which is to place in the hands of scientists, whose laboratories are removed from the advantages of a supply of town's coal gas, a complete plant of great durability and simplicity, which will manufacture and maintain a constant supply of gas. The gas is made from any kind of oil (mineral, animal or vegetable oil); it is permanent, will not condense, and has much greater calorific power than coal gas. All the appliances used for coal gas are readily adapted for use with the apparatus. All requiring such a supply of gas should get the maker's catalogue, which gives full particulars of the installation cost, &c. For the Tropics the Mansfield's Oil Gas Apparatus is essential in many places, the list at the end of the catalogue showing this very clearly.

HORLICK'S MALTED MILK.—This well-known preparation has now been before the public for more than thirty years, and the reputation it has acquired among the members of the medical profession is the best testimony to its value. It forms the best substitute for mother's milk, and is prepared with great care, under scientific supervision. The milk is not "sterilized" in the ordinary sense of the term, but is "pasteurized," that is to say, is rendered totally free from germs by being repeatedly heated to a certain temperature, 160° F., for a given time, and then cooled. This takes place at intervals of about an hour, until the milk is sterile. It is then passed on for further treatment, which consists in adding, by a special process, the extracts of wheat and malted barley. The addition of these important nutritious elements prevents coagulation in the stomach, and enormously enhances digestibility. The milk is thus perfectly pure and germ-free. It will keep indefinitely in any climate. It is of uniform composition, is always alkaline, thus resembling mother's milk, and the casein will not coagulate, but forms light flocculent flakes, easily dealt with by the weakest digestive organs. The addition of the extracts of the cereals means a great increase of flesh-forming material. There is no added cane sugar or artificial preservative in any shape, so harmful to infantile life, and so frequently present in many forms of preserved or condensed milk. The milk is obtained only from cows fed on extensive pastures in the Vale of Aylesbury. The herds are kept at the highest state of efficiency, under the most careful supervision. The supply is tested frequently, and at the slightest falling off in quality any animal is discarded. Thus the milk is always pure full-cream milk of the highest grade. The preparation may safely be recommended for infants, invalids, &c., particularly in warm climates where the difficulties of obtaining adequate supplies of fresh milk are great.

## Personal Notes.

COLONIAL MEDICAL SERVICE.

Dr. C. J. Arthur has joined the Medical Service of St. Vincent as a District Medical Officer.

Dr. G. A. Williamson, District Medical Officer, Larnaca, Cyprus, has retired from that office, to which he was appointed in the year 1895. Dr. Williamson was awarded a Certificate in Tropical Medicine by the Liverpool School in the year 1900, and was the author of a valuable Report on Malaria in Cyprus.

Dr. M. P. Duke, Senior Medical Officer, Montserrat, having obtained an extension of leave for six months, Dr. A. H. Pearce will act as Senior Medical Officer and Dr. E. S. Pearce as Junior Medical Officer of that Island.

Dr. W. H. Langley, C.M.G., the recently-appointed Principal Medical Officer of Southern Nigeria, has become an Official Member of the Executive and Legislative Councils of that Colony.

## Recent and Current Literature.

*A list of recent publications and articles bearing on tropical diseases is given below. To readers interested in any branch of tropical literature mentioned in these lists the Editors of the* JOURNAL OF TROPICAL MEDICINE AND HYGIENE *will be pleased, when possible, to send, on application, the medical journals in which the articles appear.*

**'Archiv. für Schiffs- und Tropen-Hygiene," Bd. XV., 1911, Heft 20.**

*Blackwater Fever.*—Schumacher reports a case of blackwater fever in a native child in Tanga, German East Africa. The child, three years old, was born and lived in Tanga, and was brought to hospital passing black urine. There was fever also, and Schumacher, on examining the blood, found half-grown and full-grown tertian parasites. He treated the case therefore with quinine. Such cases are rare.

**"The Journal of the American Medical Association," vol. lvii., No. 21, November 18, 1911.**

*Pellagra.*—Beal, of Fort Worth, Texas, discusses the etiology of pellagra. He inquired into the histories of fifty-four cases of the disease found in Texas, and found that of these patients but four lived near a stream or less than one-fourth mile, nine lived from one-fourth to one-half mile, while forty-one lived at least one mile; two lived eight miles, four ten miles, one twelve miles, one fifty miles and one sixty miles from any overground collection of water; a general average of over four miles. He cannot, therefore, agree with Sambon's theory that the disease occurs especially among people who live near running streams. After several observations he has been led to the conviction that the etiologic factor of pellagra is some thing or condition which exists in the home or "around the house," for in no other way can he explain the greater number of cases in females and in those males who, because of their age, spend most of their time at home.

## Notices to Correspondents.

1.—Manuscripts sent in cannot be returned.

2.—As our contributors are for the most part resident abroad, proofs will not be submitted to those dwelling outside the United Kingdom, unless specially desired and arranged for.

3.—To ensure accuracy in printing it is specially requested that all communications should be written clearly.

4.—Authors desiring reprints of their communications to the JOURNAL OF TROPICAL MEDICINE AND HYGIENE should communicate with the Publishers.

5.—Correspondents should look for replies under the heading "Answers to Correspondents."

# Colonial Medical Reports.—No. 31.—Hong Kong.

# MEDICAL REPORT FOR THE YEAR 1908.

**By J. M. ATKINSON, M.B.(Lond.), M.R.C.S., L.S.A., D.P.H.,**
*Principal Civil Medical Officer,*
AND
**W. W. PEARSE, M.D., D.P.H.,**
*Medical Officer of Health.*

## Area.

For administrative purposes the part of the Colony under the jurisdiction of the Sanitary Board is divided into two primary divisions, viz., the Island of Hong Kong and Kowloon—including only a portion, known as New Kowloon, of the New Territories.

The Island of Hong Kong is divided into five districts, namely, the City of Victoria, the Peak District, and the outlying districts of Shaukiwan, Aberdeen, and Stanley.

In the last three districts the sanitary inspection is carried out by the Police Officers of those districts.

The City of Victoria is divided into ten Health Districts with a Sanitary Inspector in charge of each.

The Inspector of Health District III., which includes most of the European quarter of the City is also in charge of the Peak.

There are also four Inspectors in Victoria in charge of disinfecting work in the district, and of the special anti-plague measures, such as house to house cleansing, rat-collecting, &c., and two Inspectors in charge of the overseeing of the Scavenging and Conservancy Contractor's work.

The Disinfecting Station at Victoria has a special Inspector in charge, while in Kowloon the duty is attended to by the Plague Inspector in addition to his duties in the district. There is a special Inspector in Victoria in charge of the Cemeteries at Happy Valley and Mount Caroline. Old Kowloon is still divided into two Health Districts with an Inspector in charge of each. There is also an Inspector in charge of the Scavenging and Conservancy Contractor's work in Old Kowloon.

The sanitary work in Kowloon City and in Sham Shui Po, villages in New Kowloon, is looked after by the Police Officers in charge there.

## General Sanitary Condition.

In connection with anti-plague measures to render houses less liable to rat infestation, 103 ground surfaces in houses have been repaired, and 811 buildings have had rat-holes filled in with cement under notice from the Sanitary Board. Rat-holes in houses are always filled in by Sanitary Department employees if such are found when houses are being disinfected, instead of calling on the owners of the property to fill them in under Sanitary Board notice. The actual number of houses thus treated is therefore very much larger than appears from the above figures. In addition 49 basements illegally inhabited were vacated under notice, 33 basement living rooms and 118 basement kitchens were granted permits for occupation and 5 basements were altered to meet the legal requirements.

Open spaces in the rear have been provided to 7 houses, while modifications with respect to the areas of such open spaces have been granted in 36 houses. Exemption from provision of a backyard has been granted in 15 houses and obstructions from backyards have been removed in 231 cases under notice from the Board. Scavenging lanes have been provided to a total length of 756 ft. and an area of 5,078 square ft. Under the direction of the Public Works Department 5,750 lineal feet of nullahs have been trained as an anti-malaria measure and the subsoil drainage of Wong Nei Chung Valley has been much improved.

## Meteorological Return.

The following Table records the meteorological conditions which prevailed during 1908:—

| Month | Barometer at M.S.L. | Temperature | | | Humidity | | Cloudiness | Sunshine | Rain | Wind | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Max. | Mean | Min. | Rel. | Abs. | | | | Dir. | Vel. |
| | ins. | ° | ° | ° | p.c. | ins. | p.c. | hours | ins. | Points | m.p.h. |
| January ... ... | 30·19 | 66·8 | 62·4 | 58·1 | 78 | 0·44 | 76 | 143·2 | 2·640 | E. by N. | 11·3 |
| February ... ... | 30·12 | 62·3 | 58·3 | 54·9 | 76 | 0·38 | 83 | 87·4 | 2·830 | E.N.E. | 14·8 |
| March ... .. | 30·09 | 65·9 | 61·2 | 57·0 | 76 | 0·42 | 66 | 146·0 | 0·765 | E. by N. | 15·4 |
| April ... ... | 29·94 | 71·7 | 68·5 | 65 5 | 89 | 0·62 | 87 | 80·8 | 11·150 | E. | 18·9 |
| May ... ... | 29·87 | 80·8 | 76·1 | 72·1 | 79 | 0·72 | 62 | 219·3 | 1·325 | E. | 12·3 |
| June ... ... | 29·78 | 83·6 | 80·2 | 77·2 | 84 | 0·87 | 84 | 147·8 | 15·245 | S.E. | 13·0 |
| July ... ... | 29·73 | 87·0 | 82·3 | 78·7 | 82 | 0·91 | 65 | 227·0 | 22·262 | S. by W. | 9·1 |
| August ... ... | 29·72 | 87·3 | 82·1 | 78·5 | 83 | 0·91 | 66 | 219·9 | 12·065 | E.S.E. | 7·1 |
| September ... | 29 86 | 85·7 | 80·9 | 77·3 | 84 | 0·88 | 67 | 179·8 | 13·720 | E. by N. | 9·0 |
| October ... ... | 29·92 | 80·8 | 76·8 | 73·4 | 78 | 0·72 | 69 | 174·4 | 5·440 | E.N.E. | 17·2 |
| November... .. | 30·09 | 75·8 | 70·2 | 65·6 | 63 | 0·48 | 60 | 189·8 | 0·145 | N.E. | 11·7 |
| December... ... | 30·13 | 67·9 | 63·3 | 59·5 | 76 | 0·45 | 75 | 101·7 | 4·285 | N.E. by E. | 10·5 |
| Mean or to al ... | 29·95 | 76·3 | 71 8 | 68·1 | 79 | 0·65 | 72 | 1,917·1 | 91·875 | E. | 12·5 |

Three public latrines have been erected during the year, viz., one at Wong Nei Chung, one at Chuk Hing Lane in Victoria, and one at Tai Kok Tsui.

Two markets have been completed during the year, viz., the vegetable market at Yaumati and the market at Sai Wan Ho (Shaukiwan). The new market at Tsim Sha Tsui was begun during the year.

The average rainfall for the decade ending 1897 was 92·6 in., and for that ending 1907, 77·3 in.

## Population.

The population of the Colony is primarily divided into Chinese and non-Chinese. The non-Chinese comprised at the Census of 1906 a white population of 12,925 of whom 6,085 were Civilians, while 4,429 belonged to the Navy and 2,411 to the Army. The coloured races (non-Chinese) numbered 8,500 and included East Indians, Asiatic Portuguese, Japanese, Filipinos, Malays, Africans, Persians, and a few others.

The following table shows the distribution according to nationality of the population as estimated for the year 1908:

| European and Americans | Africans | East Indians | Chinese and Malay | Mixed and Coloured | Total |
|---|---|---|---|---|---|
| 11,252 | 10 | 4,116 | 316,850 | 4,260 | 336,488 |

The population exclusive of the Army and Navy consists of male adults. At the 1906 Census the male population was 70·1 per cent. of the total civil population; at the 1901 Census the percentage was 72·6, so there has been an increase in the percentage of females during the past few years.

Of the Chinese population in 1906, 70·3 per cent. were males, and over half the civil population (56·9 per cent. of the Chinese, and 52·6 per cent. of the non-Chinese) were between the ages of 20 and 45 years.

The estimated population to the middle of 1908 is as follows:—

| | | |
|---|---|---|
| Non-Chinese, exclusive of the Army and Navy | | 13,200 |
| Chinese:— | | |
| City of Victoria (including Peak and Stonecutters' Island) | 177,130 | |
| Villages of Hong Kong | 17,330 | |
| Kowloon | 74,350 | |
| Floating Population | 44,940 | |
| Mercantile Marine | 2,700 | |
| | | 316,450 |
| Army (average strength) | | 4,483 |
| Navy (average strength) | | 2,355 |
| Total population of the Colony in 1908, exclusive of the New Territories (except New Kowloon) | | 336,488 |

The Chinese population of the new territories (exclusive of New Kowloon) was 85,011 at the census taken in 1901 but there are no data as yet on which to base an estimate of increase in population (if any) in this portion of the Colony since that date.

The average strength of the troops in garrison during 1908 was 141 British officers and 2,201 British N.C.O.'s and men with 35 Indian officers, and 1,664 Indian N.C.O.'s and men, and 54 Chinese attached to the Royal Engineers. There were also 348 British women and children, and 40 Indian women and children, making a total of 388.

The average strength of the British Fleet was as follows: Europeans permanently in the Colony 336, Europeans occasionally in the Colony 5,464, Chinese permanently in the Colony 143, Chinese occasionally in the Colony 164—making a total of 6,107. For the purpose of estimating the population it is considered fair to take as an average only one-third of those "occasionally" resident in the Colony; this gives 2,355.

The Chinese boat population is estimated for 1908 as 44,940 and the number of boats belonging to the port and the villages of Hong Kong is as follows:—

| | |
|---|---|
| Passenger boats | 2,805 |
| Cargo boats | 1,350 |
| Steam-launches | 268 |
| Lighters | 154 |
| Harbour boats | 1,348 |
| Fishing junks | 4,773 |
| Trading junks | 1,760 |
| | 12,458 |

In addition there belong to the new territories: Passenger boats 493, fishing junks 8,631, and other boats 31, making a grand total of 21,120.

## Births.

The births registered during the year were as follows:—

| | Males | Females | Total |
|---|---|---|---|
| Chinese | 788 | 338 | 1,126 |
| Non-Chinese | 149 | 137 | 286 |
| Total 1908... | 937 | 475 | 1,412 |
| Total 1907... | 897 | 523 | 1,420 |

This gives a general birth-rate of 4·2 per 1,000 as compared with 4·31 per 1,000 in 1907 and 4·04 per 1,000 in 1906.

The birth-rate amongst the non-Chinese community was 14·43 per 1,000 as compared with 15·95 per 1,000 in 1907 and 14·95 in 1906.

The nationalities of the non-Chinese parents were as follows: British 107, Indian 39, German 13, French 3, American 1, Portuguese 87, Filipino and Malay 20, Jewish 5, Dutch 3, Brazilian 1, Danish 1, Arabian 1, Persian 1, Mauritian 1, Spanish 1, Finnish 1, African 1.

The number of Chinese births registered does not give an accurate record of the number of births which have occurred. Owing to the custom of the Chinese of not registering a birth unless a child has survived for a month, and often in the case of female children not at all, it is probable that the majority, if not all, of the infants which die before they have lived for one month have not had their births registered. It is customary, therefore, to assume that all children not more than one month old who are found dead in the streets, harbour, hillsides, &c., by the police, and those brought in a sickly or dying condition to the various convents, have been born in the Colony but not registered. By adding the number of such children to the number of registered births a somewhat more correct number of births is probably obtained and from this is calculated a corrected birth-rate.

The number of such children in 1908 was 342 males and 509 females and one of unknown sex, total 852, which being added to the registered births makes a total of 2,264 as compared with 2,803 in 1907. The corrected birth-rate is therefore 6·72, whilst among the Chinese Community alone the rate becomes 6·2, instead of 3·55 per 1,000.

The preponderance of male over female births registered is very marked amongst the Chinese, there being 233 males to 100 females; in 1907 the proportion was 189 males to 100 females. When taking into consideration the above mentioned assumed unregistered births the proportion of males to females is 133 to 100 for 1908 as compared with 99 males to 100 females in 1907.

This suggests that even the "corrected birth-rate" is too low to approximate to the truth.

In the non-Chinese Community the proportion of male births to female births for 1908 was 108 to 100 as compared with 119 to 100 in 1907, 122 to 100 in 1906, 103 to 100 in 1905, and 83 to 100 in 1904.

## Deaths.

The deaths registered during the year numbered 9,271 (7,286 in 1907). The death-rate was therefore 27·55 per 1,000 as against 22·12 in 1907. These deaths included 986 from plague (198 in 1907).

The total number of deaths amongst the Chinese community was 8,978 which gives a death-rate of 28·35 per 1,000 (as against 22·52 in 1907).

The deaths registered among the non-Chinese community numbered 293, of which 266 were from the civil population, 20 from the army and 7 from the navy.

This gives a death-rate for the non-Chinese community of 14·78 per 1,000 as compared with 15·46 per 1,000 in 1907.

| — | Europeans and Whites | Africans | East Indians | Chinese and Malays | Mixed and Coloured | Total |
|---|---|---|---|---|---|---|
| Number of inhabitants in 1908 | 11,252 | 10 | 4,116 | 316,850 | 4,260 | 336,488 |
| Number of births in 1908 | 130 | 1 | 30 | 1,137 | 105 | 1,412 |
| Number of deaths in 1908 | 117 | 4 | 68 | 8,988 | 94 | 9,291 |
| Number of immigrants in 1908 | ... | ... | ... | 157,809 | ... | ... |
| Number of emigrants in 1908 | ... | ... | ... | 71,081 | ... | ... |
| Number of inhabitants in 1907 | 10,025 | 13 | 4,102 | 311,057 | 4,160 | 329,357 |
| Increase or decrease | +1,227 | −3 | +14 | +5,793 | +100 | +7,131 |

The nationalities of the deceased were as follows: British 75, Indian 68, Portuguese 54, German 11, Japanese 27, American 7, Malay 10, French 3, Italian 2, Spanish 2, Austrian 1, Swedish 3, Danish 4, African 4, Norwegian 3, Dutch 1, Jewish 3, Filipino 5, Cingalese 2, Hawaiian 1, Russian 1, Parsee 1, Polynesian 1, unknown 4.

The total number of deaths which occurred amongst the non-Chinese resident population was 234, and allowing 1,500 for the non-Chinese floating population this gives a death-rate of 20 per 1,000 for the resident non-Chinese Civil population estimated at 11,700.

The preceding table of population, births and deaths is given for the purpose of ready comparison with similar tables given in reports from other colonies:—

## Age Distribution of Deaths.

The number of known deaths of infants under 1 year of age was 2,099 or 22·6 per cent. of the total deaths, as compared with 22·9 per cent. in 1907 and 19·4 per cent. in 1906.

The infant mortality amongst the non-Chinese community during the year was 90·9 per 1,000 as compared with 91·2 per 1,000 in 1907.

*Chinese Infant Mortality.*—The corrected number of Chinese births in 1908 was 2,264 and the deaths under 12 months numbered 2,073. This gives a Chinese infant mortality of 915 per 1,000.

At first sight this would appear to indicate that only eighty-five children per 1,000 born in the Colony survive one year.

In the census year 1906 it was found that there were 1,329 children living in the Colony under 1 year of age, and 14,980 between 1 and 5 years of age. It must be therefore that many of the children who die under one year of age are not born in the Colony, or that comparatively few children born in the Colony have their births registered.

## Diseases.

*Respiratory Diseases.*—The total number of deaths from these diseases for the year was 2,553, of which 55 were among the non-Chinese community, leaving 2,498 among the Chinese population; 186 out of this total occurred in infants under one year of age.

Phthisis alone accounts for 769 deaths, of which 748 were Chinese, viz., 8·3 per cent. of the total deaths amongst the Chinese as compared with 9·6 per cent. in 1907.

Pneumonia caused 1,130 deaths, of which 1,106 were amongst Chinese.

The Chinese death-rate from respiratory diseases was 7·8 per 1,000 as compared with 5·8 per 1,000 in 1907; that for phthisis was 2·3 per 1,000 as compared with 2·1 in 1907.

*Nervous Diseases.*—The number of deaths under this heading for the year 1908 was 419 as compared with 522 in 1907. Of these 304 were Chinese children under 5 years of age, as compared with 424 in 1907; and 219 of these were amongst children of 1 year old or less. The principal causes of these latter deaths were convulsions, tetanus, and trismus, which accounted for 178; and meningitis, which accounted for 41 deaths.

*Malarial Fever.*—The total number of deaths from malarial fever during 1908 was 499, as compared with 579 in the previous year, a decrease of 80; of these 7 were non-Chinese, 6 being from the Civil population, and one, an Indian, from the troops.

The deaths registered as belonging to the ten City Health Districts number 133, Health District II. shows 33, and Health District X. 15 deaths.

Amongst the Kowloon land population there were 141 deaths amongst the Chinese from malaria, and 14 from the Kowloon boat population.

Shaukiwan showed 27 from the land, and 40 from the boat population, and Aberdeen 40 from the land, and 66 from the boat population.

This makes a total of 173 deaths from malaria in the outlying villages of Hong Kong as compared with 203 in 1907.

The amounts expended on nullah training for the years 1907 and 1908 were respectively 23,617 and 9,998 dols.

The following table shows the admissions for malaria to our two largest hospitals during the past ten years :—

ADMISSIONS TO HOSPITAL FOR MALARIA.

| Year | Government Civil Hospital | | Tung Wa Hospital | | Total | | Case Mortality per cent. | | |
|---|---|---|---|---|---|---|---|---|---|
| | Admissions | Deaths | Admissions | Deaths | Admissions | Deaths | Govt. Civil Hospital | Tung Wa Hospital | |
| 1899 | 475 | 5 | 305 | 58 | 780 | 63 | 1·0 | 19·0 | Average admissions, 922 Average deaths, 109 |
| 1900 | 679 | 4 | 541 | 159 | 1,220 | 163 | 0·6 | 29·4 | |
| 1901 | 787 | 10 | 507 | 122 | 1,294 | 132 | 1·3 | 24·1 | |
| 1902 | 349 | 9 | 403 | 119 | 752 | 128 | 2·6 | 29·5 | |
| 1903 | 347 | 2 | 221 | 61 | 568 | 63 | 0·6 | 27·6 | |
| 1904 | 221 | 2 | 212 | 56 | 433 | 58 | 0·9 | 26·4 | Average admissions, 504 Average deaths, 81 |
| 1905 | 266 | 6 | 153 | 48 | 419 | 54 | 2·2 | 31·4 | |
| 1906 | 233 | 7 | 248 | 96 | 481 | 103 | 3·0 | 38·5 | |
| 1907 | 247 | 8 | 305 | 87 | 552 | 95 | 3·2 | 28·5 | |
| 1908 | 282 | 3 | 355 | 93 | 637 | 96 | 1·0 | 26·2 | |

The police admissions to hospital for malaria are shown in the following table :—

POLICE ADMISSIONS TO HOSPITAL FOR MALARIA.

| | From the city | From rest of the colony | Total | Average strength of police force | Percentage of strength | |
|---|---|---|---|---|---|---|
| 1899 | ... | ... | 239 | 770 | 31 | |
| 1900 | 167 | 223 | 390 | 929 | 42 | Average, 30·8 |
| 1901 | 243 | 164 | 407 | 920 | 44 | |
| 1902 | 121 | 55 | 176 | 919 | 19 | |
| 1903 | 83 | 84 | 167 | 921 | 18 | |
| 1904 | 40 | 67 | 107 | 993 | 11 | |
| 1905 | 42 | 85 | 127 | 1,018 | 12 | Average, 10·0 |
| 1906 | 37 | 37 | 74 | 1,047 | 7 | |
| 1907 | 40 | 65 | 105 | 1,049 | 10 | |
| 1908 | 32 | 76 | 108 | 1,018 | 10 | |

The next table shows the total deaths in the Colony from malaria during each of the past ten years :—

TOTAL DEATHS FROM MALARIA.

| Year | Deaths in the city (Chinese only) | Total deaths | |
|---|---|---|---|
| 1899 ... ... | 218 | 546 | |
| 1900 ... ... | 242 | 555 | Average, 480 |
| 1901 ... ... | 281 | 574 | |
| 1902 ... ... | 189 | 425 | |
| 1903 ... ... | 152 | 300 | |
| 1904 ... ... | 90 | 301 | |
| 1905 ... ... | 87 | 287 | Average, 422 |
| 1906 ... ... | 134 | 448 | |
| 1907 ... ... | 138 | 579 | |
| 1908 ... ... | 133 | 499 | |

These tables all show a steady diminution in the number of malaria cases coincident with the establishment of anti-malarial measures.

The military return of admissions for malaria also shows a marked reduction in the incidence of this disease as will be seen from the subjoined table, when the quinquennial periods are considered. With reference to the increase in 1908 the Principal Medical Officer informs me that a third of these admissions came from Lyeemun.

ADMISSIONS FOR MALARIA, EUROPEAN TROOPS.

| Year | Strength | Admissions | Deaths | Invalided | Ratio per 1,000 | |
|---|---|---|---|---|---|---|
| 1899 | 1,643 | 829 | 5 | 25 | 504·6 | Average, 680 6 |
| 1900 | 1,484 | 629 | 4 | 16 | 423·8 | |
| 1901 | 1,673 | 1,010 | 4 | 15 | 603·7 | |
| 1902 | 1,381 | 1,523 | 6 | 24 | 1,102·8 | |
| 1903 | 1,220 | 937 | 2 | 6 | 768·0 | |
| 1904 | 1,426 | 390 | 1 | 9 | 273·5 | Average, 258·8 |
| 1905 | 1,370 | 348 | 0 | 1 | 254·0 | |
| 1906 | 1,525 | 480 | 4 | 15 | 314·7 | |
| 1907 | 1,461 | 287 | 0 | 12 | 196·0 | |
| 1908 | 2,012 | 515 | 0 | 17 | 256·0 | |

There was a marked reduction in the admissions for malaria amongst the native troops at Kowloon, the ratio of admissions per 1,000 falling from 574 in 1907 to 102·8 in 1908.

*Beri-beri.*—There were 736 deaths from this disease during 1908 (562 in 1907 and 561 in 1906), of which 8 were non-Chinese. Of these 4 were Japanese and 2 Indians from ships calling at the port. Two other Japanese cases occurred in the city.

## INFECTIOUS DISEASES.

The total number of infectious diseases notified during 1908 was 1,668 of which 1,073 were plague and 472 small pox.

*Plague.*—There was a recrudesence of this disease during the year 1908, the total number of cases recorded being 1,073 as compared with 240 in 1907 and 893 in 1906. It has frequently happened that years of mild and severe plague in the Colony have occurred alternately, so that the 1908 epidemic may, perhaps, be more justly compared with the 1906 than the 1907 outbreak.

Although in 1908 an excess of 180 cases over the number of known cases in 1906 was notified, it is quite possible that the 1908 epidemic was in reality not so severe as the 1906 one as in 1908 it appeared on inquiry that many fewer cases of plague left the Colony.

If this be true, it may be explained by the establishment of plague hospitals under Chinese management and by the adoption of less severe measures in disinfection, causing less disturbance of family life and business.

The total number of deaths from plague was 986, of which 29 were from the non-Chinese population and 957 amongst the Chinese. This gives a case mortality of 91·9 per cent. for Chinese and 90·6 per cent. for the non-Chinese cases.

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The following table shows the number of cases and deaths according to nationality :—

| | *Cases.* | *Deaths.* |
|---|---|---|
| Chinese... | 1,041 | 957 |
| British ... | 8 | 1 |
| Eurasian | 2 | 2 |
| Indian ... | 4 | 4 |
| Japanese | 5 | 5 |
| Malay ... | 1 | 1 |
| Portuguese | 10 | 10 |
| Filipino | 2 | 2 |
| Jewish ... | 4 | 3 |
| Cingalese | 1 | 1 |
| | 1,073 | 986 |

Of the total cases only three were returned as pneumonic plague.

The special staff of rat-catchers was abolished at the end of January, 1908, as it had been found that the co-operation of the Chinese could not be thereby obtained and it was not till near the end of the epidemic that a substitute scheme was adopted by which some 2,000 traps were distributed to the Chinese and several hundred special rat-bins put up throughout the City and Kowloon for the reception of rats caught by the people.

The rats are collected daily from these bins and sent for examination and if any are infected, the locality they come from is known though not the individual house. This enables the Sanitary Department to watch for warnings of plague in the different localities and if necessary to adopt special measures.

The reports of the Indian Plague Commission have been duly followed, with the result that former measures of disinfection of houses with disinfectants of the coal tar derivative series have given place to special washing of houses with a flea-killing mixture of water and an emulsion of kerosine oil with soap. Late in the year a large quantity of rat poison was obtained from India and it was decided to endeavour to keep down the numbers of rats about houses by laying down a very large number of poison baits at one time and to continue to systematically lay down poison throughout the City and Kowloon.

This wholesale laying down of poison did not begin until the last few days of 1908, but has so far given encouraging results in increasing the daily destruction of rats.

*Cholera.*—The cases of this disease recorded during the year numbered 56. One of these was a European, one a Japanese, and one an Indian. The rest were Chinese. The Japanese case and all the Chinese cases died. Nine cases were imported, six in one ship.

No spread of infection was traced to these nine imported cases. After the great floods which occurred during 1908 in the neighbourhood of Canton, cholera was more or less prevalent there, and it is very probable that in the cases, which could not be definitely considered as having been imported into the Colony, the infection was due to the arrival in the Colony of a person or persons from the neighbourhood of Canton infected — possibly so mildly as to escape detection—with the disease.

The six cases imported from one ship occurred in the last week of March, and the next case recorded was not till June 19, and occurred in a prisoner who had been three months in Victoria Gaol. Four new cases occurred in the gaol on the following four days.

No cholera was known to be occurring in the Colony outside the gaol at this time or since the six cases imported three months previously, but shortly afterwards cases began to crop up in the City, and continued through July, August, and September.

An inquiry into the outbreak of cholera in the gaol formed the subject of a special report by the Medical Officer of the Gaol and the Medical Officer of Health, and the conclusion arrived at was that in all probability the infection had been brought in by a short sentence prisoner suffering from a very mild infection of the disease.

*Typhoid Fever.*— The number of cases of this disease in 1908 was 38 as compared with 73 during 1907 and 66 in 1906. Ten of these cases were imported.

The European cases numbered 26, the Chinese 7 (one Eurasian included), and 5 cases occurred among the other non-Chinese races. Four Europeans died and all the Chinese. The European case mortality was therefore 15·3 per cent.

The source of infection of this disease, and one which is always present, is most probably, in the majority of cases, in native-grown vegetables which are manured with diluted human excreta. Raw vegetables, salads, &c., from Chinese sources should therefore never be eaten. Oysters also should be looked upon with suspicion and not eaten raw.

*Small-pox.*—The number of cases of small-pox during 1908 was 472 as compared with 341 in 1907. An epidemic may be said to have been started in December, 1907, with six cases during the month, and it extended to July 15, 1908, since when no further case was recorded.

Of these cases 20 were Europeans, 446 Chinese, and 6 of other races. Six of these cases were imported. Three Europeans and one other non-Chinese case, and 376 Chinese cases died.

The number of vaccinations during 1908 was 7,655 as compared with 6,799 in 1907.

*Diphtheria.*—Fourteen cases of diphtheria were notified during the year as compared with 43 in 1907. Four were European cases and 2 "other non-Chinese" cases, leaving 8 Chinese cases. All the Chinese cases died.

*Puerperal Fever.*—Fifteen cases of this disease were recorded during 1908, 14 of which were Chinese and 1 Portuguese. Twelve of the Chinese cases died.

### Alice Memorial Maternity Charity.

Eight Chinese midwives were employed during the year as against 6 in 1907; the 2 additional ones were employed at Kowloon, 1 at Hunghom and the other at Yaumati. Six pupil midwives were in training during the year, 3 passed the Government examination and were registered as midwives.

One thousand and forty-three confinements were attended, as against 578 in 1907, Dr. Alice Sibree being called into consultation in 49 of them.

### Disinfecting Stations.

The following articles were received for disinfection during 1908.

*Victoria Station.*

The disinfecting apparatus was in use on 241 days. The number of articles fumigated, owing to disinfection by steam being unsuitable, was 227. An additional total of 45,699 articles was disinfected at the Kowloon Station during 1908.

| | | |
|---|---|---|
| Articles from private houses | .. .. .. | 42,186 |
| ,, | Kennedy Town Hospital .. | 2,060 |
| ,, | Tung Wah Hospital .. .. | 1,175 |
| ,, | Government Civil Hospital .. | 1,510 |
| ,, | Alice Memorial Hospital.. .. | 339 |
| ,, | Convents .. .. .. .. | 90 |
| ,, | Police stations and gaol .. .. | 4,157 |
| ,, | Military hospital and barracks .. | 256 |
| Government clothing lent to contacts .. | .. | 1,403 |
| Clothing and bedding of staff .. | .. .. | 3,975 |
| Total | .. .. .. | 57,152 |

PUBLIC BATH-HOUSES.

These conveniences have been largely used by the Chinese during the year, the numbers bathing therein being as follows:—

| | |
|---|---|
| Wanchai bath-house (men only) .. .. | 151,065 |
| Second Street bath-house (men only).. .. | 57,724 |
| Pound Lane bath-house (men and women) .. | 110,056 |
| Sheung Fung Lane bath-house (women only) | 30,722 |
| Total .. .. .. | 349,567 |

AMBULANCE SERVICE.

Ambulances are kept in readiness at the disinfecting stations in Victoria and Kowloon, at the Eastern and Western Sanitary Offices in the city, the Water Police Station at Tsim-sha-tsui, the Kowlon-Canton Railway Camp and at eleven other stations.

Also outside the city limits in Hong Kong at Aberdeen, Shaukiwan and Stanley Police Stations.

At the Disinfecting Station and the Eastern and Western Sanitary Offices in Victoria, coolies are always in readiness to respond to ambulance calls, but at the other stations, which are specially for emergency use it is necessary for the police or other persons using the ambulance to hire coolies or obtain volunteers for the traction of the ambulance,

The ambulances at the Disinfecting Station and the Eastern and Western Sanitary Offices in Victoria were used 941 times during 1908, while the emergency ambulances in the city were used 72 times.

The ambulances at Kowloon were used on 216 occasions, those in Old Kowloon being called out 135 and those in New Kowloon 81 times.

OVERCROWDING.

During 1908 a modification of the law regulating overcrowding was effected.

For this offence there were 44 prosecutions with 32 convictions.

Five prosecutions were undertaken for overcrowding of opium divans in contravention of the bye-laws regulating these premises.

ADULTERATION OF FOOD AND DRUGS.

During 1908 sixty-five samples of milk were taken for analysis under the Foods and Drugs Ordinance. None were found adulterated.

A large quantity of salt beef—119 barrels—found in a godown were seized and destroyed as unfit for human food.

REPORT OF THE HEAD OF THE SANITARY DEPARTMENT.

During the year 1908 several important alterations were made in the working of the Department by the amendment of the Public Health and Buildings Ordinance which was passed in July, 1908.

The survey of the city of Victoria, and Kowloon, which was started in 1907 for the purpose of recommending modifications for cubicles under Section 154 of the Public Health and Buildings Ordinance, has been practically completed. On the recommendation of the Board modifications have been granted in 8,767 floors by the Governor-in-Council. To discourage the erection of cubicles the amending ordinance provides that where there are no cubicles in the floor the habitable space required for each person is 30 sq. ft. as compared with 50 sq. ft. in floors where cubicles have been erected. Both these measures have done much to make the law press less hardly on the poorer classes of the Chinese community.

As will be seen from the Medical Officer of Health's Report the outbreak of plague during the year was severe, there being 1,073 cases as compared with 240 in 1907 and 893 in 1906. Further attempts have been made to secure the co-operation of the Chinese in anti-plague measures. This has been fairly successful, largely owing to the work of the Public Dispensaries and Street Committees in explaining to the people the reasons for these measures. The advantage of keeping cats as an anti-plague measure has been impressed on the people, and now practically every house in the Colony possesses one or more cats. The Chinese are also now doing their own rat-catching, the Sanitary Department merely providing materials and collecting the rats. This system was not in working order till September, but since then the number of rats returned has been very satisfactory. The recommendations of the Indian Plague Commission are being carefully followed, and several changes have been made in the use of disinfectants, &c. All these changes tend to make disinfection less distasteful to the Chinese.

There were 56 cases of cholera, 38 cases of typhoid, 472 cases of small pox, and 499 cases of malaria during the year. These are all discussed in the Medical Officer of Health's Report.

REPORT OF THE SUPERINTENDENT, CIVIL HOSPITAL.

The total number of admissions was 2,527 as against 2,711 last year, and 18,207 out-patients were treated as against 17,032.

The following table gives the number and class of patients admitted during the year 1908 and the deaths: Police, 660; paying patients, 724; Government servants, 315; police cases, 285; free, 543. Total, 2,527. This shows a decrease under all headings save "free." Of the free patients 46 were Europeans as against 49 last year.

*Deaths.*—There were 157 during the year, making

RETURN OF DISEASES AND DEATHS IN 1908 AT THE CIVIL HOSPITAL.

## Hong Kong.

### GENERAL DISEASES.

| | Admissions | Deaths | Total Cases Treated |
|---|---|---|---|
| Alcoholism | 37 | 1 | 37 |
| Anæmia | 23 | 7 | 24 |
| Anthrax | — | — | — |
| Beri-beri | 56 | 7 | 56 |
| Bilharziosis | — | — | — |
| Blackwater Fever | — | — | — |
| Chicken-pox | — | — | — |
| Cholera | 1 | 1 | 1 |
| Choleraic Diarrhœa | — | — | — |
| Congenital Malformation | — | — | — |
| Debility | 103 | 1 | 106 |
| Delirium Tremens | — | — | — |
| Dengue | 13 | — | 13 |
| Diabetes Mellitus | — | — | — |
| Diabetes Insipidus | — | — | — |
| Diphtheria | 4 | 2 | 4 |
| Dysentery | 84 | 6 | 84 |
| Enteric Fever | 10 | 1 | 12 |
| Erysipelas | 2 | — | 2 |
| Febricula | 92 | — | 93 |
| Filariasis | — | — | — |
| Gonorrhœa | 63 | — | 65 |
| Gout | — | — | — |
| Hydrophobia | — | — | — |
| Influenza | 139 | 1 | 140 |
| Kala-azar | — | — | — |
| Leprosy | 2 | — | 2 |
| (*a*) Nodular | — | — | — |
| (*b*) Anæsthetic | — | — | — |
| (*c*) Mixed | — | — | — |
| Malarial Fever— | — | — | — |
| (*a*) Intermittent | — | — | — |
| Quotidian | — | — | — |
| Tertian | 49 | — | 49 |
| Quartan | 9 | — | 9 |
| Irregular | 1 | — | 1 |
| Type undiagnosed | — | — | — |
| (*b*) Remittent | — | — | — |
| (*c*) Pernicious | 220 | 1 | 223 |
| (*d*) Malarial Cachexia | — | — | — |
| Malta Fever | — | — | — |
| Measles | — | — | — |
| Mumps | 8 | — | 8 |
| New Growths— | — | — | — |
| Non-malignant | 5 | — | 5 |
| Malignant | 18 | 3 | 18 |
| Old Age | — | — | — |
| Other Diseases | 14 | — | 15 |
| Pellagra | — | — | — |
| Plague | 22 | 18 | 22 |
| Pyæmia | — | — | — |
| Rachitis | — | — | — |
| Rheumatic Fever | — | — | — |
| Rheumatism | 60 | — | 60 |
| Rheumatoid Arthritis | — | — | — |
| Scarlet Fever | — | — | — |
| Scurvy | — | — | — |
| Septicæmia | 3 | 3 | 3 |
| Sleeping Sickness | — | — | — |
| Sloughing Phagedæna | 3 | — | 3 |
| Small-pox | 3 | — | 3 |
| Syphilis | 45 | — | 47 |
| (*a*) Primary | — | — | — |
| (*b*) Secondary | — | — | — |
| (*c*) Tertiary | — | — | — |
| (*d*) Congenital | — | — | — |
| Tetanus | — | — | — |
| Trypanosoma Fever | — | — | — |
| Tubercle— | 41 | 17 | 45 |
| (*a*) Phthisis Pulmonalis | — | — | — |
| (*b*) Tuberculosis of Glands | — | — | — |
| (*c*) Lupus | — | — | — |
| (*d*) Tabes Mesenterica | — | — | — |
| GENERAL DISEASES—*continued.* | | | |
| (*e*) Tuberculous Disease of Bones | — | — | — |
| Other Tubercular Diseases | — | — | — |
| Varicella | — | — | — |
| Whooping Cough | 1 | — | 1 |
| Yaws | — | — | — |
| Yellow Fever | — | — | — |

### LOCAL DISEASES.

| | Admissions | Deaths | Total Cases Treated |
|---|---|---|---|
| Diseases of the— | | | |
| Cellular Tissue | 41 | — | 44 |
| Circulatory System— | 19 | 6 | 21 |
| (*a*) Valvular Disease of Heart | — | — | — |
| (*b*) Other Diseases | — | — | — |
| Digestive System— | 220 | 6 | 226 |
| (*a*) Diarrhœa | — | — | — |
| (*b*) Hill Diarrhœa | — | — | — |
| (*c*) Hepatitis | — | — | — |
| Congestion of Liver | — | — | — |
| (*d*) Abscess of Liver | — | — | — |
| (*e*) Tropical Liver | — | — | — |
| (*f*) Jaundice, Catarrhal | — | — | — |
| (*g*) Cirrhosis of Liver | — | — | — |
| (*h*) Acute Yellow Atrophy | — | — | — |
| (*i*) Sprue | — | — | — |
| (*j*) Other Diseases | — | — | — |
| Ear | 14 | — | 14 |
| Eye | 56 | — | 60 |
| Generative System— | — | — | — |
| Male Organs | 47 | — | 49 |
| Female Organs | 11 | — | 11 |
| Lymphatic System | 49 | — | 51 |
| Mental Diseases | 5 | — | 5 |
| Nervous System | 42 | 8 | 47 |
| Nose | — | — | — |
| Organs of Locomotion | 71 | — | 75 |
| Respiratory System | 121 | 10 | 123 |
| Skin— | 38 | — | 38 |
| (*a*) Scabies | — | — | — |
| (*b*) Ringworm | — | — | — |
| (*c*) Tinea Imbricata | — | — | — |
| (*d*) Favus | — | — | — |
| (*e*) Eczema | — | — | — |
| (*f*) Other Diseases | — | — | — |
| Urinary System | 29 | 4 | 29 |
| Injuries, General, Local— | 459 | 47 | 482 |
| (*a*) Siriasis (Heatstroke) | — | — | — |
| (*b*) Sunstroke (Heat Prostration) | 23 | 3 | 23 |
| (*c*) Other Injuries | — | — | — |
| Parasites— | 8 | — | 8 |
| Ascaris lumbricoides | — | — | — |
| Oxyuris vermicularis | — | — | — |
| Dochmius duodenalis, or Ankylostoma duodenale | — | — | — |
| Dracunculus medinensis (Guinea-worm) | — | — | — |
| Tapeworm | — | — | — |
| Poisons— | 11 | 4 | 11 |
| Snake-bites | — | — | — |
| Corrosive Acids | — | — | — |
| Metallic Poisons | — | — | — |
| Vegetable Alkaloids | — | — | — |
| Nature Unknown | — | — | — |
| Other Poisons | — | — | — |
| *Surgical Operations*— | — | — | — |
| Amputations, Major | — | — | — |
| ,, Minor | — | — | — |
| Other Operations | — | — | — |
| Eye | — | — | — |
| (*a*) Cataract | — | — | — |
| (*b*) Iridectomy | — | — | — |
| (*c*) Other Eye Operations | — | — | — |

a percentage of 6·2. Of this number 61 were moribund on admission and died within twenty-four hours.

The average daily number of sick was 88·6 as against 103·4 last year.

*Women and Children.*—There were 185 women admitted, of whom 19 died, and 49 children, of whom 7 died.

*Nationalities.*—Europeans, 594 against 715; Indians and coloured, 874 against 843; Asiatics, 1,059 against 1,153.

The death-rate among the nationalities was Europeans 3·2 per cent., Indians 4·8, and Asiatics 9.

*Diseases.*

The most prevalent diseases were: Malarial fever, febricula, influenza, dysentery, tuberculosis, rheumatism, anæmia, diseases of respiratory system, diseases of digestive system, injuries.

The largest number of deaths occurred in the following diseases: Plague, tuberculosis, diseases of respiratory system, injuries.

*Malarial Fever.*—There was again an increase under this disease, 282 against 247 in 1907 and 239 in 1906.

*Febricula.*—There was a marked decrease under this heading, 93 as against 265.

*Dengue Fever.*—Also shows a marked decrease, 13 as against 77.

*Influenza.*—There was a large increase under this heading, 140 against 11. Many of the cases were very severe, more especially as regards the lung complications, and no doubt several deaths under respiratory system were due to sequelæ of this disease.

*Typhoid Fever.*—Only 12 cases were under treatment with 1 death, as against 38 with 7 in 1907.

*Appendicitis.*—Five cases were under treatment with 2 deaths, both Chinese. Of the others two recovered without operation and one after operation.

*Operations.*

A total number of 147 operations were performed during the year (203 in 1907). Chloroform was administered 148 times, whilst a few minor operations were done under cocaine and adrenalin chloride. No casualties occurred as a result of the administration of the anæsthetics. For the first time for many years no liver abscess and no ruptured spleen were treated. Two cases of radical cure of hernia were operated on successfully by Dr. Koch, Assistant Superintendent, as also one case of suprapubic lithotomy, one case of ovarian tumour, one of resection of the knee, and one of appendicitis.

*Vaccinations.*

During the year 627 were performed as against 505 in 1907; 336 primary vaccinations of which 221 were successful, and 291 re-vaccinations with 151 successful.

*Sickness among the Police, Gaol and Sanitary Staffs.*

*Admissions.*—Six hundred and sixty cases were under treatment as against 776 in 1907, a decrease in all sections of the Force, more especially amongst the Chinese (61) and Europeans (42). The Indians (13) showed a less marked decrease. There was only one death during the year, a Chinese who died from heart disease.

*Invaliding.*—One European for mental debility; 5 Indians, 3 for tuberculosis, 1 for paresis of legs, and 1 for anæmia; and 3 Chinese, all for beri-beri.

*Malaria.*—One hundred and eight cases occurred as against 105 last year and 74 in 1906. The Europeans suffered to the extent of 8·5 per cent., Indians 21·7 per cent. and Chinese 4·2 per cent. The percentage incidence of the whole Force shows an increase of 0·9 as compared with last year. There were 15 re-admissions for this disease as against 6 last year, 11 coming in twice, 3 three times, and 1 four times.

*Dysentery.*—Thirteen cases were under treatment as against 19, the Indians furnishing most cases (8).

*Appendicitis.*—Two cases, both in Indians and both recovered.

*Gaol.*—There were 53 admissions as against 68 (62·9 against 56·2 per cent.). There were no deaths and no invaliding.

*Sanitary.*—There were 50 admissions against 72 last year. One death occurred from beri-beri and one coloured foreman was invalided for tuberculosis.

*Maternity Hospital.*

There were 82 admissions as against 87. There were 3 deaths due to plague, chronic nephritis, and shock following Cæsarean section. The second case of Cæsarean section did very well. Of those admitted 13 were wives of Government servants, 36 private paying, and 31 free.

Of the children born alive 32 were boys and 16 girls. There were 7 still-births. False pains, chronic albuminuria, miscarriage, plague, and eclampsia, account for the other cases.

REPORT OF THE MEDICAL OFFICER IN CHARGE OF THE VICTORIA HOSPITAL FOR WOMEN AND CHILDREN.

There were 234 admissions during 1908, as compared with 211 in 1907, an increase of 23. From November 24 we took over all the European women and children belonging to the garrison needing hospital treatment; 8 deaths occurred, a percentage of 3·3, as compared with 3 deaths in 1907 (1·4 per cent.).

The admissions may be classified thus:—

(1) According to age: Under 3 years, 66; between 3 and 12 years, 44 = 110; over 12 years, 124.

(2) Nationality: Europeans, 208; Asiatics, 26.

(3) Class of patients: Paying patients, 108; Government servants, 3; wives and children of Government servants, 65; free, 58.

*Malarial Fever.*—There were 23 admissions as compared with 12 in 1907. They are classified as follows: Quartan, 1; simple tertian, 10; malignant, 10; mixed infection, 2.

The *quartan* case was from the Diocesan Girls' School.

Of the *tertian*, one was from Sai Kung Police Station, two were from Kowloon, two from Tai Po Police Station, and five from Quarry Bay, all in the month of November.

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The *malignant* cases were from Bay View (5), and one each from Sai Kung Police Station, Aberdeen Police Station, Magazine Gap, Babington Path, and Lyeemun.

The cases of *mixed infection* were from Lai Chi Kok and Quarry Bay.

There were 14 operations performed during the year.

There were 20 vaccinations during the year (in 1907 = 21).

There were 22 confinements during the year, one pair of twins, all did well.

### Report on the Lunatic Asylum.

During the year 139 males and 52 females were admitted, and these, together with 16 males and 5 females remaining on December 31, 1907, make a a total of 212 patients under treatment during the year. The total admissions, 191, are fewer than in the previous year, 204.

Of the patients under treatment there were: Paying patients, 39; police cases, 114; members of police, 4; free patients, 52; Government servants, 3, total 212.

Of these cases there were repatriated or discharged 132 males and 51 females; 10 males and 1 female died, and there remained under treatment 13 males and 5 females on December 31.

Acute cases were as follows: Acute mania, 21 males and 9 females; acute melancholia, 20 males and 5 females. Alcoholism was accountable for 35 cases.

The deaths numbered 11, slightly more than 5 per cent. of the number under treatment. Causes of death: Acute mania, 6 males, 1 female; alcoholism, 1 male; dementia, 1 male; heat-stroke, 1 male.

### Report of the Medical Officer in Charge of the Hospitals for Infectious Diseases.

During the year there were 59 admissions to Kennedy Town and 100 to the hospital hulk *Hygeia*, as against 62 and 167 respectively in 1907.

Only 3 cases of plague were admitted, 2 Eurasians and 1 Chinese. All died within forty-eight hours.

The cases of malaria and beri-beri were all admitted from the Japanese steamer *Wakamiya Maru*, which arrived from Bombay with the majority of the crew suffering from fever, several having died on the voyage. The disease started shortly after the ship left Bombay, and it spread so rapidly through the crew that the Japanese ship's surgeon diagnosed it to be dengue. Seven were suffering from both diseases on admission, and 4 from beri-beri alone.

The 3 cases returned as choleraic diarrhœa exhibited all the clinical signs of true cholera, but were negative to the bacteriological tests.

#### *Small-pox.*

Eleven cases of small-pox were admitted to Kennedy Town Hospital and 86 to the *Hygeia*, but as 7 of the cases admitted to Kennedy Town were subsequently transferred to the *Hygeia*, the actual number of cases treated was 90, and of these 26 died as against 97 with 33 deaths in 1907.

Three fatal cases of discrete small-pox were children under one year.

#### *Tung Wah Small-pox Hospital.*

This hospital. which consists of a large matshed, was opened on March 6 and remained in use till July 28, when it was blown down by the typhoon, the two patients then under treatment having been transferred to Kennedy Town Hospital for safety.

Sixty-nine cases of small-pox were admitted, which includes 8 convalescents transferred from the hospital hulk *Hygeia*, so that only 61 fresh cases were admitted, and of these 30 died = 49·1 per cent. as compared with 90 cases admitted to the Government hospitals with 27 deaths = 28·8 per cent.

#### *Tung Wah Plague Hospital.*

During the year there were 280 admissions as compared with 61 in 1907.

*Plague.*—There were 275 admissions for plague and of these 1 escaped and 240 died = 87·5 per cent.

*Varieties.*

| | Bubonic | Septic | Pneumonic |
|---|---|---|---|
| Under European treatment | 15 | 0 | 0 |
| ,, Chinese ,, | 253 | 6 | 1 |
| Total | 268 | 6 | 1 |

*Deaths.*

| | Bubonic | Septic | Pneumonic |
|---|---|---|---|
| Under European treatment | 12 | 0 | 0 |
| ,, Chinese ,, | 221 | 6 | 1 |
| Total | 233 | 6 | 1 |

*Analysis of Deaths.*

| | |
|---|---|
| Died within forty-eight hours after admission | = 187 |
| ,, between second and fifth day after admission | = 42 |
| ,, after fifth day after admission | = 11 |

Therefore, of the patients who lived for more than five days after admission, 34 recovered = 75·5 per cent.

*Diseases treated.*

| | Admitted | Died | Recovered |
|---|---|---|---|
| Plague* | 275 | 240 | 34 |
| Cholera | 3 | 3 | 0 |
| Malaria | 1 | 1 | 0 |
| Syphilis | 1 | 0 | 1 |

### Report of the Medical Officer to Victoria Gaol.

The general health of the prisoners has been good. The admissions to hospital numbered 432, but of these 152 were admitted for observation and found to be malingering, so that there were 280 admissions for genuine illnesses, a percentage of 5·8 (3 in 1907) on the total admissions to the Gaol.

There were only 17 cases of dysentery with no deaths, as compared with 20 last year with 3 deaths and 38 in 1906 with 3 deaths.

The replacing of the old drinking tins by vessels made of zinc having covers will probably further reduce the incidence of this disease in the future.

Malaria shows an increase of 12 as compared with last year. Number treated in the Gaol hospital for 1908 was 68.

There were 13 cases of beri-beri as compared with 10 last year. The disease was in all cases contracted

* One escaped from the wards.

before admission to the Gaol. The number of out-patients was 750. The principal diseases were syphilis, 31 (primary, 11); diseases of the respiratory system, 158; scabies, 57; ringworm, 98; gonorrhœa, 12.

One birth occurred in the female prison; mother and child both did well.

Twenty-eight prisoners were discharged on medical grounds (for operation, 5; insanity, 5; infectious diseases, 9; pulmonary consumption, 5; broncho-pneumonia, 1; beri-beri, 2; paralysis, 1).

Six cases of cholera occurred in August. In conjunction with Dr. W. W. Pearse, Acting Medical Officer of Health, I investigated the cause of the epidemic and we submitted a special report. The disease started amongst the prisoners whose duty it was to clean the cells of the newly-admitted prisoners, and we concluded that the infection was introduced by some prisoner who only spent one night in gaol, and who was in an early stage of the disease or recovering from a mild attack.

There were 10 deaths from natural causes, and 2 suicides by hanging.

No case of corporal punishment required any after-treatment.

### Report of the Railway Medical Officer.

The general health of the Railway Staff shows a distinct improvement during the year, more especially in the camps at Beacon Hill, No. 2 Tunnel, where there has been a reduction of, approximately, 50 per cent. of cases of malarial fever.

A similar reduction has also taken place in entries for dysentery and beri-beri.

The railway work has proceeded without hindrance on account of sickness throughout the year.

The camps at No. 5 Tunnel, Taipo Kau, have been very unhealthy since work began there, but are now showing great improvement.

The Europeans especially suffered badly from malarial fever in the summer in spite of the administration of prophylactic doses of quinine.

The ground is very wet and soft, and with the repeated landslides which occurred on opening up the south end of the tunnel, pool formation could not be prevented.

The workmen, moreover, in consequence of the extremely wet nature of the ground, have had to work under most trying conditions, almost always being knee-deep in water or soft mud, and this no doubt has been a responsible factor in the incidence of sickness.

Now that the work is well in hand drainage and scavenging are being carried out as thoroughly as possible, coolie houses are frequently cleansed with disinfecting fluids, and the result has been a remarkable improvement.

Oil is used freely all over the line as a means of destroying mosquito larvæ in pools impossible to drain.

Case books have been kept at the two main camps at Beacon Hill Tunnel, and since the appointment of a resident assistant medical officer at Taipo Kau, at that place also.

It is impossible to record every case of sickness occurring amongst the coolies living in outlying mat-sheds, but, speaking generally, there has been a great decrease in all cases occurring in places not attached to main camps, as well as in the main camps themselves.

Quinine has been dealt out freely, though perhaps not so freely as formerly, as I found that a considerable amount was wasted by being thrown away into the nullahs or bartered at the small stores for food, &c., the natives, especially when new to the territory, not taking kindly to the drug, and it has often to be given under compulsion. As soon as the practice was discovered steps were taken to stop it.

Serious accidents have, fortunately, been rare during the year.

One of the most troublesome ailments at present is the effect of the dynamite fumes in the big tunnel.

The heading is about 3,000 feet from the entrance at each face. Ventilation will, however, be much improved when the headings meet in the course of a few months, allowing a free current of air through the whole length of the tunnel.

Most of the workers, especially at South face, suffer constantly from severe irritation of the throat and lungs as a result of breathing the air heavily charged with dynamite fumes.

Occasionally coolies have to be carried out from the workings, being overcome by the fumes after blasting operations. A few minutes in the fresh air, however, always revive them and there have been no serious results.

The total number of cases treated at North and South Face Camps, No. 2 Tunnel, during the year is 2,064 and for 1907, 2,667.

Of these the following are the principle diseases:—

| | 1908 | 1907 |
|---|---|---|
| Malaria ... ... | 556 | 1,168 |
| Dysentery ... ... | 53 | 124 |
| Beri-beri ... ... | 58 | 81 |
| Injuries ... ... | 354 | 371 |

The total number of patients seen at the No. 5 Tunnel camps from August (when a resident assistant medical officer was appointed, and records could be kept) to December 31 was 403.

Of these the following were the principal diseases: Malaria, ulcers, &c., skin diseases, dysentery and diarrhœa, beri-beri, injuries.

| | Sept. | Oct. | Nov. | Dec. |
|---|---|---|---|---|
| Cases of malaria ... | 48 | 41 | 32 | 18 |
| Percentage ... ... | 2·2 | 2·2 | 1·4 | 1 |

During the year 44 deaths occurred on or near the Railway Works. The following were the causes: Malaria, 14; beri-beri, 13; injuries, 7 (1 murder); dysentery, 3; heart failure, 1; small-pox, 1; plague, 1; pneumonia, 1; phthisis, 3.

A great many of these cases are unknown wanderers (not railway employees) who attach themselves to a camp when sick in hope of finding shelter.

Five Europeans have been invalided to England for the following diseases: Abscess of liver, malaria; paralytic stroke; malaria, peripheral neuritis; chronic bronchitis, peripheral neuritis; perineal abscesses, boils, &c.

The preventative measures adopted against disease —viz., scavenging, frequent cleansing of coolie-lines,

## Return of Diseases and Deaths in 1908 at the Tung Wah Hospital.

### Hong Kong.

| GENERAL DISEASES. | Admissions | Deaths | Total Cases Treated |
|---|---|---|---|
| Alcoholism | — | — | — |
| Anæmia | 34 | — | 34 |
| Anthrax | — | — | — |
| Beri-beri | 941 | 368 | 990 |
| Bilharziosis | — | — | — |
| Blackwater Fever | — | — | — |
| Chicken pox | — | — | — |
| Cholera | 35 | 30 | 35 |
| Choleraic Diarrhœa | — | — | — |
| Congenital Malformation | — | — | — |
| Debility | 20 | 3 | 22 |
| Delirium Tremens | — | — | — |
| Dengue | — | — | — |
| Diabetes Mellitus | — | — | — |
| Diabetes Insipidus | — | — | — |
| Diphtheria | 2 | 1 | 2 |
| Dysentery | 162 | 77 | 164 |
| Enteric Fever | 4 | 4 | 4 |
| Erysipelas | 11 | 1 | 12 |
| Febricula | 34 | — | 34 |
| Filariasis | — | — | — |
| Gonorrhœa | — | — | — |
| Gout | — | — | — |
| Hydrophobia | — | — | — |
| Influenza | 3 | — | 3 |
| Kala-azar | — | — | — |
| Leprosy | 14 | 3 | 14 |
| (*a*) Nodular | — | — | — |
| (*b*) Anæsthetic | — | — | — |
| (*c*) Mixed | — | — | — |
| Malarial Fever— | — | — | — |
| (*a*) Intermittent | — | — | — |
| Quotidian | — | — | — |
| Tertian | 192 | — | 197 |
| Quartan | — | — | — |
| Irregular | — | — | — |
| Type undiagnosed | — | — | — |
| (*b*) Remittent | — | — | — |
| (*c*) Pernicious | 163 | 93 | 163 |
| (*d*) Malarial Cachexia | 8 | 1 | 8 |
| Malta Fever | — | — | — |
| Measles | 1 | — | 1 |
| Mumps | — | — | — |
| New Growths— | — | — | — |
| Non-malignant | 2 | — | 2 |
| Malignant | 14 | 3 | 15 |
| Old Age | | — | — |
| Other Diseases | — | — | — |
| Pellagra | — | — | — |
| Plague | 350 | 128 | 350 |
| Pyæmia | 1 | 1 | 1 |
| Rachitis | — | — | — |
| Rheumatic Fever | — | — | — |
| Rheumatism | 88 | — | 100 |
| Rheumatoid Arthritis | — | — | — |
| Scarlet Fever | — | — | — |
| Scurvy | — | — | — |
| Septicæmia | 20 | 20 | 20 |
| Sleeping Sickness | — | — | — |
| Sloughing Phagedæna | — | — | — |
| Small-pox | 25 | 4 | 25 |
| Syphilis | — | — | — |
| (*a*) Primary | — | — | — |
| (*b*) Secondary | 18 | — | 21 |
| (*c*) Tertiary | 50 | 12 | 51 |
| (*d*) Congenital | — | — | — |
| Tetanus | 2 | 2 | 2 |
| Trypanosoma Fever | — | — | — |
| Tubercle— | 11 | 11 | 11 |
| (*a*) Phthisis Pulmonalis | — | — | — |
| (*b*) Tuberculosis of Glands | — | — | — |
| (*c*) Lupus | — | — | — |
| (*d*) Tabes Mesenterica | — | — | — |
| (*e*) Tuberculous Disease of Bones | — | — | — |
| Other Tubercular Diseases | — | — | — |
| Varicella | — | — | — |
| Whooping Cough | — | — | — |
| Yaws | — | — | — |
| Yellow Fever | — | — | — |

| LOCAL DISEASES. | Admissions | Deaths | Total Cases Treated |
|---|---|---|---|
| Diseases of the— | | | |
| Cellular Tissue | 88 | 3 | 100 |
| Circulatory System— | 111 | 51 | 113 |
| (*a*) Valvular Disease of Heart | — | — | — |
| (*b*) Other Diseases | — | — | — |
| Digestive System— | 312 | 125 | 318 |
| (*a*) Diarrhœa | — | — | — |
| (*b*) Hill Diarrhœa | — | — | — |
| (*c*) Hepatitis | — | — | — |
| Congestion of Liver | — | — | — |
| (*d*) Abscess of Liver | — | — | — |
| (*e*) Tropical Liver | — | — | — |
| (*f*) Jaundice, Catarrhal | — | — | — |
| (*g*) Cirrhosis of Liver | — | — | — |
| (*h*) Acute Yellow Atrophy | — | — | — |
| (*i*) Sprue | — | — | — |
| (*j*) Other Diseases | — | — | — |
| Ear | — | — | — |
| Eye | 57 | — | 65 |
| Generative System— | — | — | — |
| Male Organs | 7 | — | 7 |
| Female Organs | 3 | — | 3 |
| Lymphatic System | 23 | 1 | 26 |
| Mental Diseases | 7 | — | 7 |
| Nervous System | 69 | 38 | 82 |
| Nose | — | — | — |
| Organs of Locomotion | 18 | — | 20 |
| Respiratory System | 734 | 427 | 769 |
| Skin— | 167 | — | 196 |
| (*a*) Scabies | — | — | — |
| (*b*) Ringworm | — | — | — |
| (*c*) Tinea Imbricata | — | — | — |
| (*d*) Favus | — | — | — |
| (*e*) Eczema | — | — | — |
| (*f*) Other Diseases | — | — | — |
| Urinary System | 46 | 23 | 46 |
| Injuries, General, Local— | 53 | 9 | 272 |
| (*a*) Siriasis (Heatstroke) | — | — | — |
| (*b*) Sunstroke (Heat Prostration) | — | — | — |
| (*c*) Other Injuries | — | — | — |
| Parasites— | 11 | — | 11 |
| Ascaris lumbricoides | — | — | — |
| Oxyuris vermicularis | — | — | — |
| Dochmius duodenalis, or Ankylostoma duodenale | — | — | — |
| Dracunculus medinensis (Guinea-worm) | — | — | — |
| Tapeworm | — | — | — |
| Poisons— | 2 | 1 | 2 |
| Snake-bites | — | — | — |
| Corrosive Acids | — | — | — |
| Metallic Poisons | — | — | — |
| Vegetable Alkaloids | — | — | — |
| Nature Unknown | — | — | — |
| Other Poisons | — | — | — |
| *Surgical Operations*— | — | — | — |
| Amputations, Major | — | — | — |
| ,, Minor | — | — | — |
| Other Operations | — | — | — |
| Eye | — | — | — |
| (*a*) Cataract | — | — | — |
| (*b*) Iridectomy | — | — | — |
| (*c*) Other Eye Operations | — | — | — |

drainage, and the free use of quinine—have obviously resulted in diminishing considerably the incidence of the three most prominent and dangerous diseases—viz., malaria, dysentery, and beri-beri, as well as others of a less serious nature—and the results of these measures have, I think, quite justified their adoption and consequent expense. The population is, however, a floating one and fresh cases are constantly being introduced from without, a serious factor to contend with in the attempt to eradicate disease.

A noticeable feature of the dispensaries is the frequency with which the neighbouring villagers bring their sick children for medical advice and Western treatment.

### Report of the Medical Licentiate at Taipo.

*Statistics.*—The total number of new cases during the year was 2,361, as against 1,895 for the previous year. There was an increase in the number of patients as compared with last year. This was chiefly due to the active growing of works in the railway near Taipo.

The total number of old patients was 468, as against 438 for the previous year.

There were 921 cases of malarial fever, and the dysenteric cases were 29 in number, the beri-beric 24.

*The Railway.*—Out of the total register of 2,361 patients, 812 were railway employees.

*Leper Asylum.*—There were 14 lepers at the beginning of this year, Two of them died in the course of the year. In August two leprous women living in a village not far from the Asylum were admitted on the same day. The older one, aged 65, died about a month after admission. Thirteen lepers were left at the end of the year, and 10 of them were supplied with rice every day.

*Cottage Hospital.*—The total cases treated during the year were 51. There was only one woman in this number. The Chinese patients constituted 43 of the whole and Indians 8.

All with the exception of 4 were drawn from the vicinity of the camps on the railway.

Almost four-fifths of the cases admitted were destitute.

Out of the 8 patients suffering from respiratory diseases, 5 were with pneumonia and 3 phthisis. The pneumonia cases were admitted in March and April. As they were all in a serious condition on admission, the mortality is very high, *i.e.*, 80 per cent.

There were 15 deaths in the hospital during the year. Most of these were admitted in a moribund condition.

*Vaccination.*—The total cases of vaccination were 375, as against 96 last year. The increase in the number was caused by the sudden outbreak of small-pox in a village at Ping Shan, the residents of which were consequently called up to be vaccinated. The 6 cases of small-pox which happened in that village were not fatal. Only 22 cases of vaccination were unsuccessful.

### Report of the Inspecting Medical Officer of the Tung Wah Hospital.

*Statistics.*—There is a steady advance in the number of admissions, and during some parts of the year many who desired admission, and would with advantage have been treated in the wards, had to be dealt with as out-patients; while repeatedly a number of more chronic cases had to be transferred to a hospital in Canton by arrangement with the Directors of it, to relieve overcrowding in this hospital.

The admissions to the Tung Wah Hospital during the past ten years have been as follows: 1899, 2,542; 1900, 2,981; 1901, 2,989; 1902, 2,576; 1903, 2,457; 1904, 2,667; 1905, 2,833; 1906, 3,200; 1907, 3,796; 1908, 4,122.

At the beginning of the year 1908 there were 205 remaining in the wards from the previous year; 4,122 patients were admitted during the year, making a total of 4,327 cases; 2,678 were discharged; 1,400 died, leaving 209 remaining in the hospital at the close of the year.

Of the 4,327 cases, 427 were transferred elsewhere for treatment, as follows: 23 to the Government Civil Hospital, 238 to the infectious diseases hospitals, and 166 to Canton.

Of the fatal cases, 450 were in a dying condition at the time of admission, and died within twenty-four hours.

There remains a net total of 3,245 patients actually treated in the Tung Wah Hospital, of whom 1,611, *i.e.*, 49·6 per cent., were under treatment by European methods, and 1,634, *i.e.*, 50·4 per cent., under Chinese native treatment.

The number of visits to the out-patient department was 90,650 (70,843 in 1907). 87,847 were seen by the Chinese native doctors, and 2,803 by Drs. Jen and Leung.

2,348 persons were vaccinated at, and in connection with, the hospital (1,405 in 1907). Vaccinations are performed by Dr. Leung Chik Fan, who attends the villages for this purpose.

2,425 destitute persons were temporarily sheltered and fed, until they could be sent to their native villages or otherwise be provided for (950 in 1907).

1,258 dead bodies were brought to the hospital mortuary to await burial (696 in 1907). For purposes of registration, diagnosis of the probable cause of death is made in all possible cases by inspection of the body and cross-questioning of relatives as to the symptoms preceding death. Where internal examination is considered necessary for medico-legal or public health reasons, or because of contradictory statements regarding the fatal illness, such examination is made at the public mortuary. During the past year 131 bodies of persons brought in dead, and also 108 bodies of persons who died in the hospital, chiefly of persons who were moribund at the time of admission, *i.e.*, 239 in all, were sent to the Government public mortuary for *post-mortem* examination (199 in 1907).

The infectious diseases branches of the hospital were under the supervision of Dr. Moore throughout the year. The registers show admission as follows: Plague Branch, 275; Small-pox Branch, 69.

Cases requiring operation are so far as possible persuaded to go to the Government Civil Hospital, and this is more easily done than in earlier years, few cases where such transference is urged by the Inspecting Medical Officer refusing consent.

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Dr. G. Montagu Harston continues to attend at the hospital on Mondays and Fridays at 4.30 p.m. to see eye out-patients. 687 new cases were seen (487 in 1907), and 2,550 visits were made to this department. Of the new cases, 292 were trachoma: 62 pupils were sent from various schools to be examined for this disease, and of these 44 were found to be cases of trachoma, the remainder suffering from other diseases of the eye. 103 eye operations were performed.

Beri-beri continues to increase in the Colony. Admissions and deaths during the past ten years have been as follows:—

| | Admissions | Deaths | Per cent. |
|---|---|---|---|
| 1899 | 279 | 123 | 44 |
| 1900 | 361 | 214 | 59 |
| 1901 | 412 | 219 | 53 |
| 1902 | 414 | 217 | 52 |
| 1903 | 277 | 170 | 61 |
| 1904 | 742 | 329 | 44 |
| 1905 | 731 | 344 | 47 |
| 1906 | 517 | 257 | 49 |
| 1907 | 812 | 282 | 34 |
| 1908 | 941 | 368 | 39 |

Malaria also shows an increase; but this is due almost entirely to the large number of admissions from the railway works, and is the result of conditions that will disappear when these works are completed, and when the permanent railway employees will be doubtless adequately protected from malaria. The admissions and deaths from this disease during the past ten years have been as follows:—

| | Admissions | Deaths | Per cent. |
|---|---|---|---|
| 1899 | 305 | 58 | 19 |
| 1900 | 541 | 159 | 29 |
| 1901 | 507 | 122 | 24 |
| 1902 | 403 | 119 | 29 |
| 1903 | 221 | 61 | 27 |
| 1904 | 212 | 56 | 26 |
| 1905 | 153 | 48 | 31 |
| 1906 | 248 | 96 | 38 |
| 1907 | 304 | 87 | 28 |
| 1908 | 355 | 93 | 26 |

The Hospital has been duly inspected by the Visiting Justices twice monthly and has been certified by them to have been found on all occasions clean and in good order.

*Alice Memorial Hospital.*—Admissions, 152; deaths, 2; total, 163.

*Alice Memorial Maternity Hospital.*—Admissions, 198; deaths, 7; total, 202.

*Nethersole Hospital.*—Admissions, 374; deaths, 25; total, 395.

*Ho Min Ling Hospital.*—Admissions, 290; deaths, 11; total, 308.

### Report of the Government Bacteriologist.

The routine examination of the Tytam, Pokfulam and Kowloon services has been continued regularly throughout the year. These upland surface waters are of high bacteriological purity. A few other waters have been examined.

Nine disinfectants have been examined for their carbolic acid co-efficient, and about twenty-five other reports have been issued on various materials sent for diagnosis.

Vaccine statistics, giving the number of tubes for each year: 1902, 4,616; 1903, 5,361; 1904, 6,893; 1905, 7,639; 1906, 8,797; 1907, 13,666; 1908, 17,536.

Issues of vaccine lymph giving the number of tubes: Victoria Goal, 2,141; Tung Wah Hospital, 1,644; Government Civil Hospital, 390; Nethersole Hospital, 192; Alice Memorial Hospital, 550; Victoria Hospital, 34; Kennedy Town Hospital, 20; Sanitary Department, 98; Railway Medical Officer, 102; Colleges and Convents, 110; Chinese Public Dispensaries—Hunghom, 125; Central, 540; Eastern, 695; Western, 540; Kowloon, 155; Yaumati, 355; Taipo Dispensary, 923; other Public Vaccinators, 95; other issues, 8,827; total, 17,536.

Material examined for infectious diseases of man was: typhoid, 17; diphtheria, 7; cholera, 10; tuberculosis, 6.

Examination for rat plague: found infected, 157.

### The Public Mortuary, Victoria.

During six months of the year the work at the mortuary has been done by myself. During the other six months Drs. Moore, Thomson, and Koch have done the work.

Report on *post-mortems*: Male bodies examined, 1,329; female, 1,373; sex undetermined, 3; total, 2,705.

Claimed bodies sent from hospitals and other places, 2,006; unclaimed bodies mostly abandoned, 699.

There is a large increase in the number of bodies sent by the Convents.

### The Public Mortuary, Kowloon.

The total number of *post-mortems* made during the year amounted to 1,137.

### Report of the Government Analyst.

The number of analyses performed was 517.

The following classification shows the nature of the work done: Chemico-legal—Toxicological (including fourteen stomachs), 58; articles for stains, 19; articles for fire inquiry, 4. Potable waters—Public supplies, 36; wells, &c., 25. Dangerous Goods Ordinance—Petroleum oil, 82; liquid fuel, 8. Food and Drugs Ordinance—Brandy, 6; flour, 1; milk, 67; whisky, 20; port wine, 3; beer, 7; opium, 56. Building materials—Cement, 3; concrete, 1; powder for waterproofing concrete, 1. Prepared Opium Ordinance—Substances, 8; opium pills, 8; powders, 2; lozenges, 1. Pharmacy Ordinance—Medicines for poisons, 4. Mineralogical, &c.—Coins, 1; metals, 11; ores, 17; coal, 5. Miscellaneous—Aerated waters, 3; coal-tar disinfectants, 4; rat destroyers, 2; codeine phosphate, 3; crucibles, 3; chloride of lime, 2; chemicals, 22; condensed milk, 2; public gas supply, 12; lotion, lime-juice, linseed oil, medicine, spirit of wine, pyroligneous liquid, acetate of lime, turpentine, scum, magpie dung—1 each, 10.

Among the chemico-legal investigations conducted were fourteen cases of suspected human poisoning. Realgar was separated in one case, lysol in one, arsenic in three, and opium in three cases. The head of a fish was sent for examination as it was suspected to belong to a poisonous kind. It was identified as a

species of tetrodon. It has on several occasions caused death in the Colony. Probably only a prolonged investigation would isolate the poisonous principle of this fish, but the undertaking of this, or of any other similar subject of inquiry, would interfere with necessary routine work, and is therefore indefinitely held over. The fish is known to the Chinese as Ki Pau. It is stated that it requires particular preparation for food, and that certain other kinds of food should never be cooked with it, as these latter may fix the poison. From these statements it appears that the poison is probably of a volatile nature, present only in certain parts of the fish, and which by well boiling may be dissipated.

On February 9, on the tankship *Nerite* there occurred an explosion which killed and badly burned two men and injured another so severely that he died later. Evidence showed that in the forehold there was a paint locker containing about thirty open tins of paint and an open drum of turpentine. Work was going on with naked lights at the bottom of the hold. There was no petroleum on board and all the tanks and pipes had been ventilated. An explosion occurred first in the paint locker and afterwards in the hold itself, causing injury as stated. No damage was done to the vessel. I pointed out at the inquiry that a paint locker containing dangerous articles should not form part of a hold.

*Food and Drugs Ordinance.*—The following sixty-six analyses were made at the instance of the Police and the Sanitary Board, and all were found genuine: Beer, 6; brandy, 4; milk, 35; port wine, 3; whisky, 18.

The public continue to take advantage of the Laboratory and have forwarded a great variety of examples for examination on payment.

### Report of the Health Officer of the Port.

The work of the Department may be comprised under three separate sections, viz.:—

The daily inspection of shipping arriving in the port.

The inspection of emigrants.

Quarantine duty.

*The Daily Inspection of Shipping.*—This work consists in boarding all steamers as they arrive in port between the hours of 6 a.m. and 6 p.m. During the year there were 3,991 arrivals, of which 1,933 were British and 2,058 were foreign; while the departures amounted to 4,010, of which 1,936 were British and 2,074 were foreign. These figures include sailing ships but are exclusive of the Canton and Macao River steamers; these latter as well as junks and smaller craft are not boarded by us except in the event of any infectious disease being present on arrival here.

His Majesty's ships and foreign ships of war are not boarded by us.

*The Inspection of Emigrants.*—The total number of emigrants during the year amounted to 71,081 and shows a decrease of 34,886 as compared with the figures for 1907.

Of this total the majority were for the Straits Settlements, viz., 49,643, while the remaining 21,438 were for other ports such as San Francisco, Victoria, Seattle, Salina Cruz, Mauritius, &c.

The wave of emigration reached its maximum during the month of March, when 8,882 emigrants left the Colony, while the minimum occurred during the month of February, when only 2,994 left; this can be accounted for by the fact that the Chinese New Year in February kept back a great many who postponed their departure till after the holiday season.

The total rejections amounted to 882 which may be classified under the following headings:—

*Skin Diseases.*—Chiefly scabies, ringworm and chronic ulcers.

*Tuberculosis.* — Phthisis, enlarged cervical and inguinal glands.

*Eye Diseases.* — Such as pronounced trachoma, purulent ophthalmia, and blindness.

*Syphilis.*—With well-marked secondaries.

*Jaundice.*—From various causes.

*Beri-beri.*—With well-marked ataxia or dropsy.

*Fevers.*—Malaria, small-pox, plague, &c.

*Deformities.* — Such as kyphosis, scoliosis or paralysis.

*Old Age.*—Including great physical debility and emaciation.

The male emigrants are divided into two classes: (1) assisted, and (2) free.

"Assisted" emigrants are labourers whose passages are wholly or partly paid for them, in return for which they are bound to work for a certain period for the person who engages them; this is generally 360 days in the Straits Settlements, North Borneo and all the Java ports, with the exception of Billiton, where the term is extended to two years. These labourers require to have certificates and photographs, and they travel in charge of an agent. "Assisted" emigrants for the Java ports undergo an examination for fitness and disease by a private medical practitioner prior to the official examination on board the steamer.

The "free" labourers pay their own passages and are not bound in any way to the employers of labour.

There is a constant stream of returning emigrants from various ports, chiefly Singapore, and many thousands arrive annually. Thus during the year, 489 steamers arrived, with a total of 157,809 persons. These are not usually examined by us on arrival, except in the event of epidemic disease occurring on the voyage, when the course of procedure is in accordance with Rule 3 under Section 19 of Ordinance No. 10 of 1899.

*Quarantine Duty.*—During the year there were in all fifteen vessels detained in quarantine for the following reasons: Small-pox, 10; cholera, 2; plague, 2; dengue, 1; anthrax in cattle, 0; total 15.

Several vessels were fumigated and disinfected for enteric fever cases landed here from time to time, and these being solitary cases which were isolated on board, the ships were not dealt with as under Rule 3 of the Quarantine regulations. Thus the ss. *Newchwang*, which landed a case of enteric on January 1, and the *Yawata Maru*, which had another case on May 11, were disinfected while discharging cargo at their berths.

Several cases of parotitis occurred on the trooper *Northbrooke* from Bombay; these were treated on

board, and were convalescent on arrival in Hong Kong, where satisfactory disinfection was carried out by the ship's surgeon. A single case of parotitis also occurred on the *Empress of Japan* on June 24.

On October 3 the ss. *Wakamiya Maru* arrived in port with twenty-nine cases of dengue. Thirty-seven cases occurred on the voyage from Bombay, and these were entirely confined to the Japanese crew. There were three deaths, five recovered on the voyage, and the remaining twenty-nine cases were landed and admitted to the Kennedy Town Hospital. Several of these cases appeared to be suffering from beri-beri as well, as evidenced by symptoms of extreme paresis, with exaggerated reflexes and well-marked hyperæsthesia.

During the year the following ports were declared to be infected:—

Amoy for cholera from August 19 to October 3.

Manila for cholera from September 25 to November 20.

Singapore for cholera from December 5.

Bangkok for cholera from December 19.

Both Singapore and Bangkok were under quarantine restrictions at the end of the year.

## Report of the Colonial Veterinary Surgeon.

### *General Statistics.*

The total number of cattle admitted to the Government depôts for the year was 42,098, a decrease on the previous year of 17901. In Kennedy Town 37,982 were admitted, a decrease of 17,837 on last year, due to the fact that during July, August, and September no cattle were exported to Manila owing to restrictions imposed by the Manila Government. In Kowloon 4,116 cattle were admitted, a decrease of 64 on last year. In Kennedy Town 151 cattle were rejected alive as unfit for food, and in Kowloon 6 were rejected.

The total number of pigs admitted to Kennedy Town was 168,682, against 186,728 in 1907. The dealers attribute the falling off to the floods on the North River, from which district many pigs come.

The total number of sheep admitted to Kennedy Town was 30,118, against 28,349 in the previous year.

### *Disease in the Depôts.*

*Foot-and-mouth-Disease.*—This disease was more or less prevalent during the year. In the early part of the summer the disease was of a very virulent type, but it became much more mild towards the end of the year.

*Anthrax.*—Four cases of anthrax occurred, three of them in June and one in October. The three cases in June were all in one shipment, and all died within three days of arrival. The case in October was in a bullock that had been in the depôt for ten days.

*Rinderpest.*—Cases of this disease were met with throughout the year, and the Chinese importers state that the disease was prevalent on the mainland. As a rule the dealers send down only those cattle that appear to them to be healthy, but as these cattle have been in contact with sick cattle, some develop the disease after arrival. On September 5 and 7 two lots of cattle were admitted in the depôt suffering from rinderpest, and these were slaughtered by order of the Sanitary Board. No compensation was payable as the cattle were sick on arrival in the Colony.

*Black Quarter.*—One calf, about 9 months old, died from this disease in the depôt.

*Parasites.*—A few cases of whipworm (*Trichocephalus affinis*) were found in young animals, but probably many more exist, as this worm, owing to its small size, is not easy to find unless by careful searching. It does not appear to be of much economic importance.

Large numbers of filariæ were found in the walls of the aortas of both Chinese cattle and water buffaloes. These have been described by Lingard as occurring in India, and have also been found in cattle in the Straits Settlements. They give rise to an atheromatous condition of the blood-vessels, but do not appear to be fatal. I have not been able to find the embryonic form in the blood.

The following biting flies have been identified, and are the two most common flies in the cattle-sheds: (1) *Stomoxys calcitrans* and (2) the horn-fly (*Lyperosia irritans*). Both flies cause cattle a good deal of annoyance. One specimen of the *Tabaniidæ* was caught but has not yet been identified. These flies are not common in Hong Kong.

### *Buildings.*

There were no alterations or new buildings at Kennedy Town.

In March the new slaughter-house and animal depôt at Ma Tau Kok was completed and occupied, and the old buildings at Hung Hom handed over to the Canton-Kowloon Railway. The new building, while satisfactory, is not so easily accessible as the old one.

The numbers of animals slaughtered in the Colony during the past year was: cattle, 29,612; sheep and goats, 18,104; swine, 185,231.

### *Dairies and Cowsheds.*

A somewhat severe outbreak of rinderpest occurred at the Dairy Farm Company's premises. In the beginning the type of disease was severe, but a milder type prevailed later. Serum inoculations were carried out with fairly satisfactory results, and a number of young stock were immunized against the disease by the simultaneous inoculation method. Toward the end of the year the disease again appeared, and serum inoculations were again practised. The outbreak was not finished at the end of the year.

Foot-and-mouth disease broke out in Kennedy's dairy and the Dairy Farm Company's premises at almost the same time. The type of the disease was very severe.

The Chinese dairies were free from epidemics.

### *Importation of Beef and Mutton.*

The importations of fresh beef and mutton were respectively 338,270 lb. and 301,139 lb. This meat is imported from Australia by the Dairy Farm Company.

### *Inspection of Cattle Transports.*

Under Ordinance No. 15 of 1903, eighty-one visits of inspection were paid to ships leaving the Colony with more than ten head of cattle on board. In 1907, 159 such visits were paid. The decrease is due to the fact that the importation of cattle into the Philip-

pine Islands from Hong Kong was for some time forbidden by the Philippine Government on account of disease. In connection with this matter I was sent down to Manila to make inquiries and see what could be done towards re-opening the trade. The regulations for the import of cattle into the Philippines were modified tentatively and subsequently further alterations were made, with the result that the cattle export trade recommenced. Ultimately the cattle trade between here and the Philippines passed wholly into the hands of an American-Filipino syndicate who employ a veterinary surgeon of their own to inoculate all cattle against rinderpest, and by the end of the year the trade had resumed its former dimensions.

*New Territories.*

Foot-and-mouth disease appeared in Sheung Sui and some of the neighbouring villages, but soon died out. The police endeavoured to restrict the movements of cattle as far as possible. The same disease also broke out among the draught bullocks of the Kowloon-Canton Railway at Fan Ling and Sha Tin. The disease was of a mild type, and no deaths were reported.

## Colonial Medical Reports.—No. 2.—Mauritius.

# MEDICAL REPORT FOR THE YEAR 1908.

**By L. G. BARBEAU, M.B.C.M.Edin., D.P.H.Lond.,**

*Acting Director.*

STATISTICS OF POPULATION.

The total estimated population of the Colony on December 31, 1908, was 374,237, showing a decrease of 2,398 as compared with that of the previous year. The decrease is due in part to an excess of emigration over immigration, but principally to the fact that the deaths during the year exceeded the births by 1,640.

The number of deaths registered during the course of 1908 was 15,096, and the death-rate 40 per mille, against 13,037 and a death-rate of 34·7 per mille in 1907. The year under review is comparable in that respect with 1906, when the figures were 15,379 and 40 per mille respectively. The mortality was highest in Port Louis town and district and lowest at Moka. The average death-rate for the ten years ended 1907 was 36·3 per mille.

The birth-rate was 35·7 per mille, showing a falling off from that of 1907, which was 37·7, as well as from the average of the previous ten years, which was 36·1. Rivière du Rempart was the district which showed the highest, and Flacq that which had the lowest birth-rate.

The figures from which the above data were obtained are given in a tabular form in Annexure I (*a*) kindly supplied by the Registrar-General.

PREVALENCE OF SICKNESS.

There was a further and marked increase in the number of patients admitted into the hospitals and asylums of the Colony during the year under review as compared with the two preceding ones. The admissions rose to 27,751 in 1908, against 23,355 and 20,371 in 1907 and 1906 respectively, but contrary to what obtained in 1907, the case mortality rose to 5·79 per cent., being ·45 per cent. higher than that of the previous year. Concurrently the number of cases treated in the dispensaries increased to 66,077 against 55,635 in 1907.

Judging therefore from the standard of comparison adopted in previous reports, it may be said that the sanitary condition of the Colony during 1908 was inferior to what it had been the year previous as shown by the higher general and hospital death-rates, lowered birth-rate and larger number of attendances both at the hospitals and at the dispensaries. The increased calls for free medical assistance were probably partly due, however, to the financial difficulties through which the Colony has passed as well as to the fact that a larger proportion of the population have now realized the facilities offered by the charitable institutions maintained by Government and are more inclined to take advantage of them.

*Malarial Fever.*—The admissions for that disease numbered 5,071 in 1908 against 4,272 in 1907.

The cases were returned as follows: Quotidian, 2,233; tertian, 332; quartan, 46; irregular, 647; remittent, 142; pernicious, 20; unclassed, 1,651.

The case mortality for all types taken together was ·93 per cent. as compared with 1·06 in the preceding, year.

*Hypertrophy of the Spleen.*—There were 1,193 admissions for that complaint as compared with 816 in 1907, and a corresponding increase in the deaths from the same cause which rose to 47 against 20 in the previous twelve months. No new fact has come to light of a nature to alter the opinion already expressed that kala-azar does not exist in the Colony, so that these cases must provisionally, at any rate, be regarded as malarial in their nature.

*Dysentery.*—As in the case of the above two diseases the admissions for this complaint show a distinct increase when compared with the preceding year, the figures being 1,605 and 1,286 respectively.

*Enteric Fever.*—Sixty-four cases of this disease were treated in the hospitals, including two that were admitted at the end of 1907, with 16 deaths.

*Diphtheria.*—Sixteen cases were admitted in the hospitals, six of which proved fatal. The admissions for 1907 were five, with three deaths.

*Influenza.*—A fall is apparent in the admissions for that affection, which accounted for 1,051 cases, as compared with 1,264 and 1,768 in 1907 and 1906 respectively. The deaths numbered thirty-four.

*Pneumonia.*—On the other hand the admissions for pneumonia rose from 411 to 508, with a slightly lower case-mortality of 33·8 per cent.

**Colonial Medical Reports.—No. 2.—Mauritius**—(*continued*).

*Cerebro-spinal Meningitis.*—A small epidemic of this complaint was observed during the year covered by this report, resulting in the admission into the hospitals of fifteen cases, twelve of which terminated fatally.

*Beri-beri.*—The epidemic described in the annual report for 1907 showed no tendency to recur during 1908; only eight new cases were admitted, in every one of which the patient effected a recovery.

*Nephritis.*—The sustained rise in the admissions for that complaint, which has already been recorded in previous reports, was again manifest in 1908. Whereas the cases admitted in the hospitals in 1906 and 1907 numbered 285 and 426 respectively, 669 fresh cases were returned in the year under review from the same institutions.

*Measles.*—The epidemic which broke out in 1907 continued during the earlier months of 1908, seventy-two fresh cases being admitted in the hospitals with five deaths. This affection was probably answerable for the increased number of admissions for pulmonary complaints during 1908.

*Syphilis.*—The cases of this disease admitted into the hospitals rose from 463 in 1907 to 563 in 1908. The following figures show the progress of the disease in the Colony during the last five years: 1904, 352; 1905, 359; 1906, 433; 1907, 463; 1908, 563.

*Leprosy.*—Seventeen cases received temporary in the public hospitals against twenty in 1907.

*Plague.*—This disease gave only seventeen admissions as compared with twenty in the preceding year.

*Mental Diseases.*—The general hospitals received seventy-five patients suffering from mental disorders previous to their being transferred to the lunatic asylum or otherwise provided for. The number of inmates at the asylum on December 31, 1908, was 431, a reduction in the number present on the same date in 1907, but there has been an increase in the daily average population of that Institution which passed from 430 in 1907 to 433 in the year under review.

The total number of certified lunatics in the Colony including the patients out on probation and those accommodated in the lunatic wards of the Barkly Asylum was 608 in 1908, giving a proportion of one insane in every 615 of the population.

### Meteorological Conditions.

The total amount of rain collected at the Observatory, 62·43 inches, was above the average. The first four months were wet, March particularly so, when the rainfall was 59 per cent. above normal.

The mean temperature was 73·6° as compared with 73·1 for the year before and generally speaking the year under review proved a hotter one.

The range between the shade minima and maxima reached 25·3 in 1908, against 23·8 in 1907.

The average degree of humidity was similarly higher, standing at 75·5½ as compared with 74 in the preceding year.

The influence of these unfavourable meteorological conditions upon the public health manifested itself especially during the first half of the year. Following upon the heavy rainfall in December, 1907, and January, 1908, a rapid rise took place in the number of admissions from malaria in the early part of the latter year. The annual epidemic recurrence of that disease which proved both severe and extensive reached its acme in February, but the downpour which accompanied the cyclonic disturbance of February 29, and March 1, was followed by a recrudescence in May which was not sustained however, probably owing to the advent of the cool season, after which the incidence of malaria gradually fell until it reached its lowest point in October.

### Recurrence of Particular Diseases.

*Dysentery.*—The apparent increase in the occurrence of this disease is attributable to the same causes as were active, though in a different manner, in the causation of malaria. The actual type of the disease has not yet been definitely established, but there are indications that many of the cases are of amœbic origin. Although in isolated outbreaks infection may possibly have taken place through the instrumentality of flies or dust, there seems to be good ground for regarding the contamination of the rivers and streams, which serve very generally as sources of water supply, with excremental matter as the principal channel of infection.

*Enteric Fever.*—A further increase is observable in the number of cases of this disease notified under the Infectious Diseases Ordinance of 1898, 229 cases having been registered against 145 in the previous year. If it is stated that the figure for 1907 showed an increase of 80 per cent. over that of 1906 it would appear at first sight that typhoid fever is rapidly spreading in the Colony. As explained, however, in last year's report, this rise in the incidence of the disease is more apparent than real and is probably to be accounted for by greater accuracy of diagnosis, principally through the assistance furnished by the bacteriological laboratory. In this connection it may be pointed out that in spite of the much larger number of cases notified the deaths from typhoid have only exceeded by nine those recorded in 1907. Moreover the death-rate from that cause for all notified cases, which was 25·5 per cent. in the latter year, fell to 15·7 per cent. in 1908, a fact which tends to show that owing to greater facilities of diagnosis many milder cases were notified which would otherwise have escaped registration.

The districts most affected were Plaines Wilhems, Moka Rivière du Rempart and Port Louis, the first heading the list as usual. On the whole the cases were pretty evenly distributed throughout the year, with a tendency perhaps to be slightly more numerous during the second half. There was an absence of explosive outbreaks. The disease appeared in the form of scattered cases or small groups of cases, the original source of infection remaining usually obscure or undiscoverable. The impression which is derived from a study of these occurrences is that the infection was principally kept up and disseminated through the agency of bacilli carriers.

In connection with this subject it may be as well to mention that it is not unfrequent to meet with cases of more or less continued fever refractory to

quinine with no malarial parasites in the blood, and in which Widal's reaction is negative. These cases which appear to be neither malarial nor typhoid in their nature seem to point to the existence in the Island of a febrile affection or affections, possibly similar to the unclassified fevers of India, regarding which it is to be hoped more accurate knowledge will be acquired with the assistance of the bacteriological laboratory.

*Diphtheria.*—The cases of diphtheria notified during the year rose to 114 against sixty in 1907. Although as in the case of enteric fever this increase is no doubt partly due to greater accuracy of diagnosis yet the higher fatality of the disease (fourteen deaths were ascribed to that cause) is probably an index of actual enhanced prevalence. The districts most affected were Plaines Wilhems, Moka and Port Louis. Anti-diphtheritic serum from the Lister Institute was supplied by Government to all who applied for it, no charge being made in the case of persons unable to pay. A certain quantity is always kept in readiness at the bacteriological laboratory to permit of the early application of the treatment whenever necessary after examination of the preparation.

*Measles.*—The epidemic of measles referred to in the report for 1907 continued during the year under review. The outbreak was at its height in January when 162 cases were registered, but rapidly abated until by the end of the year it had practically disappeared. The total number of cases notified to this department was 476 with twenty-seven or a mortality of 5·6 per cent. The districts most affected were those of Plaines Wilhems, Savanne and Grand Port.

*Plague.*—The total number of cases recorded during the year was 167, showing a reduction of 57 upon that for the preceding year. The annual epidemic recurrence was slow in asserting itself and it was not until September that the disease can be said to have become prevalent. As a consequence the epidemic only reached its maximum in November instead of October as is usually the case. In spite of a somewhat virulent recrudescence at Port Louis it is satisfactory to note that the tendency to decline manifested by plague since 1906 has been maintained, the epidemic of 1908 being the smallest registered since 1899. Moreover, with the exception of two small outbreaks at Souillac and at The Mount and Mon Goût (Pamplemouses), the disease has been entirely confined to the districts of Port Louis and Plaines Wilhems, which may be regarded as the only two indigenous foci in existence. In view of the small number of cases (six) detected in the latter district the hope may not unreasonably be entertained that it may before long be rid of the scourge.

In the course of the year the Lazaret at Souillac had to be reopened for a few weeks. The number of admissions at the Port Louis Lazarats was sixty-four. Towards the end of December Bois Savon Lazaret was closed and for the sake of economy the plague hospital and segregation camp at Grand River were organized for the accommodation of plague cases and contacts from Port Louis and Plaines Wilhems until further orders.

The campaign was conducted on the same general lines as before, special prominence being given to the destruction of rats and disinfection of contaminated and insanitary premises. The total amount spent on plague measures generally during the calendar year was Rs. 120,827.93.

The number of rats destroyed by the Health Department was 81,958 at Port Louis and 90,546 in the rural districts, giving a total of 172,504 against 125,558 in 1907. Of these 11,518 were microscopically examined and 234 were found plague infected.

*Cerebro-spinal Meningitis.*—Twenty cases of this affection were reported during the year. Although it had not previously been unknown in the Colony where it was probably introduced from India, it is the first time it has ever assumed anything like epidemic form. It has accordingly been added to the diseases notification of which is compulsory. Cases were observed in the prisons at Port Louis, Plaines Wilhems and Savanne and in private practice in the same districts and at Rivière du Rempart. It manifested no marked tendency to spread, but in such cases as were discovered it showed the same high degree of fatality as is usually associated with the disease in other countries, sixteen out of twenty cases ending in death or a mortality of 80 per cent.

*Influenza.*—This disease which for some years past has assumed epidemic prevalence annually, made its appearance in the colder months of 1908, but as already stated and for reasons little known, though probably connected with climatic conditions, has not prevailed with the same intensity as before during the period covered by this report.

*Bronchitis and Pneumonia.*—Contrary to what might have been expected from the foregoing paragraph, bronchitis and pneumonia have been more prevalent in 1908 than the year before. This is probably to be accounted for by the fact that in many cases these affections may have been late complications of an attack of measles.

*Beri-beri.*—This disease showed no tendency to recur in epidemic form. In addition to the cases admitted in the public hospitals, a few scattered cases were reported by private medical practitioners. These cases were too few and disseminated to permit of definite conclusions being drawn as to their probable cause.

*Nephritis.*—This affection, whatever may be its etiology, is steadily on the increase in the Island.

*Scarlet Fever.*—Two cases of this affection was notified, one at Port Louis and the other at Moka; they were both of a mild type. Doubts are being entertained as to the identity of the disease as observed here with true scarlatina.

*Erysipelas.*—This disease assumed some epidemic prevalence during the year, seventy-three cases being notified with sixteen deaths.

*Leprosy.*—From information kindly furnished by the Poor Law Commissioner it appears that little change has taken place in the number of lepers maintained at the St. Lazare Asylum at the expense of Government. This, as previously mentioned, is no criterion of the progress of the disease in the Island as segregation in the asylum is not compulsory, but when taken in conjunction with the fact that the year 1908 has been financially a difficult one for a large proportion of the population, it seems at any rate to indicate that the affection is not on the increase.

*Surra.*—Occasional cases of this epizootic among

RETURN OF DISEASES AND DEATHS IN 1907 AMONGST EUROPEANS AND NATIVES IN THE

## Colony of Mauritius.

### GENERAL DISEASES.

| | Admissions | Deaths | Total Cases Treated |
|---|---|---|---|
| Alcoholism | 2 | — | 2 |
| Anæmia | 584 | 7 | 598 |
| Anthrax | — | — | — |
| Beri-beri | 8 | 2 | 11 |
| Bilharziosis | — | — | — |
| Blackwater Fever | — | — | — |
| Chicken pox | 15 | — | 15 |
| Cholera | — | — | — |
| Choleraic Diarrhœa | — | — | — |
| Congenital Malformation | — | — | — |
| Debility | 694 | 155 | 709 |
| Delirium Tremens | — | — | — |
| Dengue | — | — | — |
| Diabetes Mellitus | 34 | 4 | 38 |
| Diabetes Insipidus | 1 | — | 1 |
| Diphtheria | 16 | 6 | 16 |
| Dysentery | 1605 | 245 | 1646 |
| Enteric Fever | 62 | 16 | 64 |
| Erysipelas | 68 | 13 | 70 |
| Febricula | 2 | — | 2 |
| Filariasis | — | — | — |
| Gonorrhœa | 356 | — | 365 |
| Gout | 2 | — | 2 |
| Hydrophobia | — | — | — |
| Influenza | 1051 | 34 | 1067 |
| Kala-azar | — | — | — |
| Leprosy | — | — | — |
| (*a*) Nodular | 7 | — | 7 |
| (*b*) Anæsthetic | 10 | — | 10 |
| (*c*) Mixed | — | — | — |
| Malarial Fever— | — | — | — |
| (*a*) Intermittent | — | — | — |
| Quotidian | 2233 | 14 | 2254 |
| Tertian | 332 | 1 | 341 |
| Quartan | 46 | 1 | 46 |
| Irregular | 647 | 5 | 650 |
| Type undiagnosed | 1651 | 3 | 1668 |
| (*b*) Remittent | 142 | 14 | 155 |
| (*c*) Pernicious | 20 | 10 | 20 |
| (*d*) Malarial Cachexia | — | — | — |
| Malta Fever | — | — | — |
| Measles | 72 | 5 | 77 |
| Mumps | — | — | — |
| New Growths— | — | — | — |
| Non-malignant | 71 | — | 72 |
| Malignant | 57 | 11 | 59 |
| Old Age | — | — | — |
| Other Diseases | 255 | 18 | 234 |
| Pellagra | — | — | — |
| Plague | 17 | 10 | 17 |
| Pyæmia | 2 | 2 | 2 |
| Rachitis | — | — | — |
| Rheumatic Fever | 19 | 1 | 20 |
| Rheumatism | 648 | — | 658 |
| Rheumatoid Arthritis | — | — | — |
| Scarlet Fever | — | — | — |
| Scurvy | 24 | — | 24 |
| Septicæmia | 5 | 3 | 5 |
| Sleeping Sickness | — | — | — |
| Sloughing Phagedæna | 2 | — | 2 |
| Small-pox | — | — | — |
| Syphilis | — | — | — |
| (*a*) Primary | 179 | — | 183 |
| (*b*) Secondary | 225 | 1 | 228 |
| (*c*) Tertiary | 136 | 6 | 142 |
| (*d*) Congenital | 21 | 5 | 27 |
| Tetanus | 9 | 4 | 9 |
| Trypanosoma Fever | — | — | — |
| Tubercle— | 1266 | 344 | 1319 |
| (*a*) Phthisis Pulmonalis | — | — | — |
| (*b*) Tuberculosis of Glands | — | — | — |
| (*c*) Lupus | — | — | — |
| (*d*) Tabes Mesenterica | — | — | — |
| (*e*) Tuberculous Disease of Bones | — | — | — |
| Other Tubercular Diseases | — | — | — |
| Varicella | — | — | — |
| Whooping Cough | — | — | — |
| Yaws | — | — | — |
| Yellow Fever | — | — | — |

### LOCAL DISEASES.

| | Admissions | Deaths | Total Cases Treated |
|---|---|---|---|
| Diseases of the— | | | |
| Cellular Tissue | 1183 | 33 | 1221 |
| Circulatory System— | — | — | — |
| (*a*) Valvular Disease of Heart | 210 | 56 | 216 |
| (*b*) Other Diseases | 58 | 16 | 59 |
| Digestive System— | — | — | — |
| (*a*) Diarrhœa | 521 | 19 | 526 |
| (*b*) Hill Diarrhœa | — | — | — |
| (*c*) Hepatitis | 126 | 3 | 128 |
| Congestion of Liver | — | — | — |
| (*d*) Abscess of Liver | — | — | — |
| (*e*) Tropical Liver | — | — | — |
| (*f*) Jaundice, Catarrhal | — | — | — |
| (*g*) Cirrhosis of Liver | 94 | 14 | 97 |
| (*h*) Acute Yellow Atrophy | — | — | — |
| (*i*) Sprue | — | — | — |
| (*j*) Other Diseases | 1176 | 72 | 1191 |
| Ear | 75 | 2 | 77 |
| Eye | 370 | — | 383 |
| Generative System— | — | — | — |
| Male Organs | 506 | — | 537 |
| Female Organs | 256 | 2 | 262 |
| Lymphatic System | 1345 | 47 | 1382 |
| Mental Diseases | — | — | — |
| Nervous System | 444 | 43 | 465 |
| Nose | 15 | — | 15 |
| Organs of Locomotion | 222 | 6 | 232 |
| Respiratory System | 1970 | 217 | 1999 |
| Skin— | 1165 | — | 1195 |
| (*a*) Scabies | — | — | — |
| (*b*) Ringworm | — | — | — |
| (*c*) Tinea Imbricata | — | — | — |
| (*d*) Favus | — | — | — |
| (*e*) Eczema | 280 | — | 283 |
| (*f*) Other Diseases | — | — | — |
| Urinary System | 839 | 137 | 855 |
| Injuries, General, Local— | 1098 | 23 | 1139 |
| (*a*) Siriasis (Heatstroke) | — | — | — |
| (*b*) Sunstroke (Heat Prostration) | — | — | — |
| (*c*) Other Injuries | — | — | — |
| Parasites— | 1380 | — | 1495 |
| Ascaris lumbricoides | — | — | — |
| Oxyuris vermicularis | — | — | — |
| Dochmius duodenalis, or Ankylostoma duodenale | 135 | 7 | 138 |
| Dracunculus medinensis (Guinea-worm) | — | — | — |
| Tapeworm | 3 | — | 3 |
| Poisons— | — | — | — |
| Snake-bites | — | — | — |
| Corrosive Acids | — | — | — |
| Metallic Poisons | 4 | 1 | 4 |
| Vegetable Alkaloids | 2 | — | 2 |
| Nature Unknown | — | — | — |
| Other Poisons | 4 | — | 4 |
| *Surgical Operations*— | — | — | — |
| Amputations, Major | 44 | 3 | 44 |
| ,, Minor | | | |
| Other Operations | 2140 | 42 | 2140 |
| Eye | 81 | — | 81 |
| (*a*) Cataract | — | — | — |
| (*b*) Iridectomy | — | — | — |
| (*c*) Other Eye Operations | — | — | — |

equines and bovines were reported during the year, but it has on the whole been less prevalent than in 1907.

### Malaria.

The Colony has suffered from a widespread and rather severe visitation of this disease dnring the year under reference. For the first time for many years the number of admissions in the hospitals did not show the usual alternance noted in previous reports.

The admissions (5,071) were the largest recorded during the past ten years with one exception, and nearly equalled those of 1905, which reached 5,123. This is no doubt to be explained by the heavy rains of the earlier and hotter months of the year, the higher average temperature and higher degree of humidity, but much of this unfortunate state of things was however probably also brought about by the financial stringency which was such a marked feature in the history of the Island. A further argument in support of this view is found in the increased number of cases of splenic enlargement due apparently entirely to chronic malaria that claimed admission. These cases were probably due to old standing infection and would under other circumstances not have come to hospital at all.

Allowing for this, the year under review must still, I think, be regarded as a bad one in respect to malaria. On comparing the figures for the year with those given by Prof. Ross for the period 1900-06, it is found that the death-rate from that cause rose from 14.0 to 15.5 per mille of the population and that the ratio of malarial deaths to total deaths was 38.6 per cent. against 31.0 per cent. Similarly the number of cases of malaria treated at the hospitals and dispensaries in 1908 reached 30,458 against 28,294 in the preceding year.

Every effort was made that could be made with the means at the disposal of the Department to cope with the requirements of the situation.

Prof. Ross' visit to this Colony came to an end on February 25th, 1908, but the mosquito-brigade work which had been initiated meanwhile was continued under the supervision of Mr. d'Emmerez de Charmoy with ten "moustiquiers" and a number of labourers at a cost of Rs. 7,898·10. Much good work was done by these gangs in looking for and destroying mosquito breeding places, but owing to their small number as compared with the extent of country to be covered, their action, which has been confined practically to some of the more populous areas, only could exercise but little influence over the general incidence of the disease. They will, however, prove very useful as a trained nucleus for a more comprehensive organization when Prof. Ross' recommendations are carried into effect.

Every effort was made to maintain the drainage channels at Clairfond in the highest state of efficiency and although anopheles mosquitoes were still to be found in small numbers in the locality, there was no indication at the close of the year of any return among the civil population of the epidemic which had prevailed with such intensity during the previous malarial season.

Quinine was distributed free from thirty-five depôts established in the more malarious localities and from the public dispensaries. Arrangements were also made to permit of Government servants receiving salary at the rate of Rs. 720 and under being supplied with the drug free of charge from the hospital and dispensaries. The total quantity of the drug issued from the Medical Stores during the year was 414 lb. 15 oz. 39 grs., worth Rs. 5,055.26.

### Vaccination.

The number of children vaccinated at the public vaccine stations was 11,638. Among these 11,501 were successfully vaccinated while the operation proved unsuccessfully in forty-seven and the result could not be ascertained in the case of the remaining ninety. The proportion of successes was therefore 98·87 per cent. of the total number vaccinated, and this proportion would be still higher (99·6 per cent.) if the ninety cases in which the result has remained unknown were left out of account.

The children vaccinated by the public vaccinators represented over 86 per cent. of the births during the year and their number exceeded by 1,124 that for the preceding year, in spite of the reduced birth-rate.

### Hospitals, Asylums and Dispensaries.

In spite of the financial embarrassments of the Colony the Hospitals and Asylums already in existence all continued to be maintained by Government. The free medical assistance afforded to the sick poor was fully taken advantage of by the population, the total number of admissions rising from 23,355 in 1907 to 27,751, and many hospitals were unduly full for a longer or shorter period during the unhealthier portion of the year.

The dispensaries afforded relief to 66,077 patients against 55,635 in 1907. With a view to relieve distress and prevent overcrowding of the hospitals at a time when sickness was at its highest, the dispensary medical officers were authorized by Government, with the concurrence of the Poor Law Commissioner, to issue beef, bread and other necessaries of life to the destitute sick.

The number of these institutions was at first increased to twenty-nine by the opening of a temporary dispensary at Black River, but towards the end of the year it was found possible to close the Pounce Street dispensary at Port Louis, the necessity for which had greatly diminished since the transfer of the central dispensary to its present location in Rempert Street.

### Miscellaneous.

*Port and Quarantine Work.*—During the year 208 vessels were boarded by the Health Officer. Of these 176 were offered immediate pratique, but twenty-one refused and performed their operations in quarantine because of the existence of plague in the Colony.

Of the thirty-two vessels placed in quarantine fourteen were only detained a short time for purposes of disinfection, the cabin passengers being in most cases allowed to land at once on giving a satisfactory reference ashore. The remaining eighteen were detained for a variable time to complete the quarantine period to which they were liable.

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Re-vaccination of passengers and crews was resorted to in the case of six vessels quarantined for small-pox, the total number of persons so dealt with being two hundred and forty-one.

The Harbour Disinfecting Station was utilized on twenty different occasions for the disinfection of incoming and outgoing passengers.

Cannoniers Point Quarantine Station was occupied for five days for the accomodation of the passengers ex S.S. "Wardha." Flat Island Station was not used during the year.

*Laboratory Work.*—The work done at the Bacteriological Laboratory has formed the subject of reports by Dr. Lafont which have been transmitted to Government.

## Colonial Medical Reports.—No. 3.—Calcutta.

# MEDICAL REPORT FOR THE YEAR 1908.

**By T. FREDERICK PEARSE, M.D., F.R.C.S.Eng., M.R.C.P.Lond., D.P.H.Cantab.**

*Health Officer.*

The year 1908 may be considered to have been a healthy one. The total number of deaths amounted to 27,689, a smaller death roll (with the exception of 1904) than the city has had since 1899. This total gives a death-rate calculated on the census population of 32·6 per 1,000. If we assume, as we are fairly justified in doing, that the population of the city has increased since 1901 at the same rate that it did during the preceding decade we may estimate that there were on April 1, 1908, 987,288 inhabitants. The death-rate calculated on this estimated increased population would be only 28·0 per 1,000.

This is a lower corrected death-rate than can be worked out for over ten years.

As I showed in my previous report, this estimate of 28 per 1,000 cannot be taken as the true death-rate of the city, because, although due allowance has been made for increase of population, no further correction has been made for the peculiar constitution of the population. Calcutta, as compared with Bengal, has a population favourable for a low death-rate—*i.e.*, comparatively few children and a very large proportion of young adult males; and therefore to make a just comparison of the mortality in Calcutta with that for Bengal (and equally so for other cities) it is necessary to make correction for the different numbers of the population at the several age periods and in the two sexes. Applying then, the Calcutta death-rates at the several age periods to a miniature population of Bengal (equal to that of Calcutta) we find that instead of the 27,689 deaths returned in 1908 for Calcutta there would have been 31,950 deaths, were the Calcutta population similar to that of Bengal. This number of deaths calculated on the census population would give a death-rate of 37·7 per 1,000 as compared with the recorded rate of 32·6, mentioned previously as the uncorrected rate for Calcutta. To arrive at the correct rate we must apportion this total of deaths (31,950) to the estimated increased population, and we then obtain a rate of 32·3 per 1,000. This must be considered as the true death-rate for Calcutta during the year 1908.

It will be seen from the foregoing that the effect of the increase of population since the census, in diminishing the death-rate, is almost neutralized by the effect on the death-rate of the peculiar constitution of the population, so that, curiously enough, it works out that the uncorrected death-rate for the city is approximately the true death-rate.

The shifting character of the Calcutta population is well-known, but the amount of the annual influx is hardly realized. The increase of the population during 1908 may be roughly estimated at 21,000, notwithstanding that the deaths exceeded the births by 10,646, indicating that the influx into the city was probably not less than 32,000 persons.

The death-rates at the different age periods per 1,000 living at those periods were as follows:—

| | Males | Females |
|---|---|---|
| Under 1 year .. .. .. | 274·4 | 263·0 |
| 1 year and under 5 years .. .. | 46·0 | 45·0 |
| 5 years ,, 10 .. .. .. | 10·3 | 16·2 |
| 10 ,, ,, 15 ,, .. .. | 16·0 | 17·6 |
| 15 ,, ,, 20 ,, .. .. | 19·3 | 25·1 |
| 20 ,, ,, 30 ,, .. .. | 15·3 | 25·3 |
| 30 ,, ,, 40 ,, .. .. | 23·8 | 34·2 |
| 40 ,, ,, 50 ,, .. .. | 20·4 | 23·5 |
| 50 ,, ,, 60 ,, .. .. | 31·4 | 35·0 |
| 60 ,, and upwards.. .. .. | 109·9 | 108·6 |

The death-rates of females at all ages, except at the two extremes of life, were higher than those for males—the total female mortality giving a death-rate of 40 per 1,000, as against the male death-rate of 28·8 per 1,000. The comparative healthiness of the past year was chiefly due to the lessened mortality from small-pox and plague, but fewer deaths were recorded from malaria, "other fevers," dysentery and diarrhœa, and also from "all other causes." The reduction of mortality was therefore general and on that account is the more satisfactory.

There is a great contrast in the mortality of the old town (urban Calcutta), 28·8 per 1,000 as compared with the suburbs, 42 per 1,000. The death-rate of the Fringe Area is estimated at 33·7 per 1,000. The difference is due to a greater mortality in the suburbs from cholera, malaria (more than double) "other fevers" (over 50 per cent.), dysentery and diarrhœa (3 times as prevalent) and from "all other diseases." Malaria is still more fatal in the Fringe Area, which suffers less however than the suburbs from "other diseases."

The advantages of fairly complete drainage and the comparative absence of open and polluted tanks in the old town must be taken as largely contributing to its healthiness. Under practically every heading, however, there are more deaths in the suburbs. The season of the year has its own regular rate of mortality, the monsoon period being the healthiest, with a steady rise in mortality up to a maximum in the following April, followed by a rapid decline towards the next wet season. Most of the epidemics occur in the spring and account for the high mortality of this period.

The different rates of mortality amongst the several classes deserve attention. Amongst Hindus the general death-rate was 34·9 per 1,000, amongst Mahomedans 29 per 1,000, and amongst Christians 27·2 per 1,000. These differences are explained by the larger proportion of deaths among Hindus from cholera (two and a-half times as many as amongst Mahomedans), from small-pox (three times as many) from plague (twice as many) from enteric fever, from remittent fever, acute pneumonia, and dysentery, diarrhœa, and other intestinal fluxes. On the other hand, Mahommedans have more deaths in proportion to their numbers from malaria, old age, bronchitis, asthma, and puerperal fever. In the two sexes the greater proportion of deaths from phthisis and bronchitis amongst females is very marked.

*Births and Birth-rates.*—Births registered during the year amounted to 17,043, as against 16,224 in the previous year. This number gives a birth-rate on the total (census) population of 20·1 per 1,000; on the total female (census) population of 59·7 per 1,000; on the female (census) population between the ages of 15 and 45 years of 113·2 per 1000; and on the number of married women between the ages of 15 and 45 years, of 164 per 1,000. The last method, viz., by calculating on the number of married women of child-bearing ages, is not only the correct method, but the only means by which fair comparison can be made of one place with another.

I showed in my previous report the uselessness of calculating the birth-rate on the total population of Calcutta, which contains such a large excess of males and comparatively few children. It is equally disadvantageous to calculate it on the total female population, because the proportion of females between the ages of 15 and 45 years, and also the proportion of married females between those ages differs from those ruling in Bengal.

It would appear that the married women in Calcutta have fewer children than their sisters in Bengal. This apparent discrepancy may be explained: (*a*) by women leaving the city for the births of their children; (*b*) by defects in the registration of births; (*c*) by the inclusion of prostitutes amongst the population of married women. Putting aside these explanations for a moment, and assuming that the married women in Calcutta have as many children as in Bengal, there ought to have been registered 24,116 births instead of the 17,043 recorded. Such a total would give a birth-rate for the whole city on the census population of 28·4 per 1,000. As Bengal had a birth-rate of 37·7 per 1,000, with its married women aged 15-45 forming about one-sixth of the population, as compared with the married women in Calcutta, forming less than one-eighth of the population, it will be at once obvious how useless it is to calculate the birth-rate of Calcutta on the whole population. With the most perfect registration, and without women leaving the city, it would therefore be impossible, with the present character of the Calcutta population, to get a birth-rate higher than 28·4 per 1,000. With the estimated growth of the population (viz., for 1908 of 987,288 inhabitants), the birth-rate works out at 17·2 per 1,000 instead of the rate of 20·1 per 1,000, calculated on the census population. We have done better than in previous years, but we must admit, apart from the custom of women leaving the city, that our system of registration is defective. Strictly speaking, parents ought to register the births of their children, but they do not; and our registration offices, with peripatetic sub-registrars, do not secure a correct record of all the births. The system of having peripatetic sub-registrars has now been on its trial throughout the city for over twelve months. Some improvement has been effected, and I do not advise any alteration for the present.

*Infant Mortality.*—There were 4,595 deaths of infants—2,436 being males and 2,159 females. It is usual to estimate the rate of infant mortality on the total number of children whose births were registered during the year. This was 17,043, so that the death-rate was 269 per 1,000. The infant mortality of 4,595 compares favourably with that of last year (4,754). The rate for males was 274·4 and for females 263·0 per 1,000. In addition there were reported 1,038 still-births, forming 5·7 per cent. of the total births registered. Still-births, however, are not included either amongst ordinary births or deaths, but are always recorded separately. The still-births were less in number than in 1907. In Bombay (1907) still-births formed 11 per cent. of the total number of births.

It is a curious fact that for many countries the rate of infantile mortality is approximately ten times that of the death-rate for the whole community, so that with a general death-rate of 28 per 1,000 it is not extraordinary for Calcutta to have an infantile death-rate approaching to 280 per 1,000. Last year the rate was 293 per 1,000. In English towns during 1907 the general death-rate was 16·4 per 1,000 while the infantile death-rate was only 127 per 1,000. On the other hand, Bombay had a death-rate amongst infants of 423 per 1,000, but in that city only 11,785 births were registered. One reason given for the high infant death-rate in Calcutta is that women leave the city for the births of their children so that all the births do not get registered as belonging to that city, whilst they return afterwards with their infants, and deaths amongst these infants go to swell the infant death-roll. It is impossible to estimate the correctness of this statement with accuracy, but it is probable that nearly 20 per cent. of the mothers leave the city for the births of their children.

The infantile mortality fluctuates irregularly during the year. This is dependent (a) upon the varying numbers of children born in each month; (b) on the prevalence of those diseases which chiefly affect their mortality.

The following comparison may be interesting:—

RATES OF INFANTILE DEATHS PER 1,000 BIRTHS.

| | 1907 | Calcutta, 1908 | England and Wales, 1907 |
|---|---|---|---|
| Infectious diseases .. | 21·63 .. | 9·8 .. | 8·67 |
| Diarrhœal ,, .. | 21·26 .. | 21·0 .. | 14·06 |
| Convulsions and tetanus.. | 63·36 .. | 48·2 .. | 11·06 |
| Prematurity and wasting diseases | 76·86 .. | 65·6 .. | 43·18 |
| Pulmonary diseases .. | 84·38 .. | 93·3 .. | 23·43 |
| All other diseases .. .. | 25·53 .. | 31·1 .. | 17·22 |
| | 293·02 .. | 269·0 .. | 117·62 |

These rates for Calcutta are much the same as in 1907. Convulsions and tetanus carry off a very large proportion of infants during the first two weeks of life and pulmonary diseases have been particularly fatal during the past year.

## THE BILIARY CIRRHOSIS OF INFANTS, OTHERWISE KNOWN AS INFANTILE LIVER.

For many years a peculiar disease of the liver of infants, accompanied with fever and attended with a high mortality, has been recognized in India (Bengal).

The morbid anatomy and pathology of this disease were well described by Lieut. Col. Gibbons, I.M.S. (retired), in 1891, who considered it a form of biliary cirrhosis and suggested that the term "intercellular cirrhosis" would be appropriate, as there occurred a primary development of fibrous connective tissue within the lobules between the liver cells. The other organs of the body seem unaffected, except the kidney, which shows marked degeneration and shedding of the epithelium of the tubules. The usual *post-mortem* appearances were œdema of feet and legs and generally of face and hands, and a small quantity of fluid in the abdomen. All the tissues of the body are bile-stained. In the earlier stages the liver is enlarged, but later it becomes small. There is no perihepatitis, but the liver substance is tough and the outer-surface granular. The liver cells are much altered, many being destroyed and others converted into masses of granular debris. In the interlobular bands of connective tissue many bile ducts are found. The intercellular fibres are not applied closely to the degenerated cells, but form a network, in the spaces of which the degenerated cells lie. It was suggested that the disease is due to an irritant which primarily attacks the liver cells, but which also leads to proliferation of the connective tissue elements. The proliferation of the bile ducts is not so easily explained, but it was suggested by Paltang to be a curative process, in which a regeneration is brought about by a multiplication of bile ducts from which masses of liver cells were formed. The disease is not due to alcohol, there is no evidence of syphilis, and the pathological changes are quite different from the liver enlargement which follows malaria.

The disease varies in its duration, sometimes lasting a month only, at others for perhaps two years. Generally the first symptom noticed is enlargement of the liver, but early symptoms are nausea, vomiting, sallow complexion and slight fever. The child loses its appetite, becomes irritable, develops thirst and becomes distinctly feverish, especially towards night. The liver enlargement progresses and may become very intensive. Some tenderness over the liver is detected. In the later stages jaundice sets in and the child is markedly ill. Œdema occurs also in the later stages. There is a deficient excretion of bile, the stools being clayey and whitish, but the urine is deeply stained. The fever seems to increase with the disease.

The prognosis is extremely unfavourable. The disease is said to be common in Madras, and it has been seen in Bombay.

We had in Calcutta in 1907 no less than 636 deaths of children from this disease. Of this number, 92 only were under 12 months; 138 only were over 2 years. The great bulk of the cases, viz., 64 per cent., died at ages between 1 and 2 years. The mortality amongst Hindu children is greater than amongst Mahomedans, but male and female children are about equally attacked.

Our returns for 1908 show 727 deaths from this disease, distributed as follows: Hindus 596, Mahomedans 124, mixed races 2, other classes 5. It is therefore much more common amongst Hindus, even taking into consideration their larger population. From the large mortality annually occurring from this disease the statistics are of more than purely medical interest.

### *Incidence of Particular Diseases.*

(1) *Cholera.*—The outbreak of this disease following the Ardhodoya Joge was described in my last report. After this outbreak, which extended to the end of June, there was but little cholera during the remainder of the year. The total mortality for the year was 3,694, a larger death roll, with the exception of 1907, than has been recorded during the last twenty years. Of this total no less than 3,224 deaths occurred between February and June. The death-rate for the year from the disease was 4·3 per 1,000.

Since December, 1908, when there were 46 deaths, the cholera mortality has been steadily rising, the deaths in January being 60, in February 97, in March 409.

As in previous years the wards bordering on the river and Tolly's Nullah were the most affected.

The incidence of the disease amongst Hindus is very striking. This community forms about 65 per cent. of the total population, but 82 per cent. of the deaths occurred in it.

It is a matter for serious reflection that, notwithstanding the improved and increased water supply for the city, the death-rate from cholera has been as great, if not greater, during the past two decades than it was previously, and the past ten years has shown a higher mortality than in the previous decade. This disease is universally recognized as due to drinking polluted water. That the municipal supply is not at fault is proved, amongst other reasons, by the comparatively low incidence among other classes than Hindus. The wells and tanks only supply limited areas and such sources when infected only occasion small localized outbreaks. There remains the river, the canal, and Tolly's Nullah, and I can only attribute the persistence of cholera in Calcutta, with the outbreaks which periodically attack it, as due to the use of these waters. In this respect the customs of the Hindus make them the greatest sufferers. Cholera

apparently never leaves Calcutta entirely, but the amount of the disease is subject to wide fluctuations, as in other parts of Bengal. I do not believe that Calcutta infects itself, so to speak, or that the recurring outbreaks are always indigenous in origin. Numerous deaths occur amongst the thousands who are continually streaming into the city and many local outbreaks, if not many of the general epidemics, are due to infection brought in. We may, I think, fairly assume that as the disease wanders, so to speak, over Bengal, infecting place after place, the several attacks are due to the import of infected individuals, with the concomitant pollution of water supplies. The River Hooghly, like the Ganges, probably receives from time to time the germs of this disease, whence they come we know not, and with such infection it produces outbreaks of cholera along its course, until it ceases to be dangerous. Pollution of the river from some source or other is the only explanation of the continuance of epidemic cholera in the city.

### On the Influence of Festivals on Cholera Mortality.

1891.—A severe outbreak of cholera followed the Ardhodoya Joge (February 8), which continued for many weeks.

A moderate increase for several weeks followed the Durga Pujas.

1895.—An increase followed the festival of Malhai Sankranti (January 13.) A sharp outbreak occurred after Shivaratri, March 18.

Again an increase after Durga Puja, September 25, lasting till the end of the year.

1896.—A very severe outbreak followed the lunar eclipse (February 28), lasting for thirteen weeks.

An increase occurred after Rasjatra (November 29).

1897.—A severe outbreak occurred from February 20 to May 15, three festivals falling during this period.

1900.—An increase commenced after Maghi Purnima (February 14), and lasted for fourteen weeks to May 19. Two other festivals also occurred during this period.

A sharp and short outbreak followed Snanjatra (June 13). A very sudden and sharp but short outbreak followed Mohalaya (September 23), and a rise followed Rasjatra (November 6).

1902.—A rise followed Makar Sunkranti (January 12), and a severe outbreak followed Maghi Purnima (February 22), lasting until May 3. Also a rise followed Rasjatra.

1905. A short sharp outbreak followed Makar Sankranti (January 13). Also an increase after Shibratri (March 3) and Baruni (April 1).

An increase followed Janmastami (August 11). Continued after Pujahs (September 24), past Rasjatra, (November 31) and lasted to the end of the year.

1906.—An increase followed Maghi Purnima (February 8) for a few weeks.

An increase followed Dasahara. An increase followed Pujahs (October 25), and Rasjatra (November 11) up to end of year.

1907.—Solar eclipse (January 14) severe outbreak increasing from January 12 (very bad week), following eclipse and lasting four weeks. Increase followed Dasahara (June 21). Increase followed Durga Pujah and a bad increase from November 16 (Rasjatra) to December 14.

1908.—A very severe and long-continued outbreak followed the Ardhodoya Joge of February 2, lasting until the end of May. A small increase followed Dasahara festival, but the rest of the year was free from further outbreak.

These facts speak for themselves. The explanation is that these festivals are accompanied by a free use of the foul waters of the River Hooghly and Tolly's Nullah. The death roll is also increased by the advent of pilgrims.

The special festival of the Ardhodoya Joge seems particularly disastrous, and so also do solar and lunar eclipses, all of which are special bathing occasions.

The year 1908 may be said to have been a moderate one for small-pox—578 deaths only been recorded. There was a slight outbreak in March, April, and May, but otherwise there was a diffusion of the cases over the whole year. As in the two preceding years, two definite and severe outbreaks had occurred, a third successive recrudescence was not expected. District I, as usual, was the most affected. Hindus suffered to a much greater extent than any other community.

In December, 1908, there was a sudden rise in the mortality (91 deaths) from that of the previous month, affecting chiefly the northern half of the city and almost exclusively the Hindu population,

A severe outbreak has developed since the beginning of the year 1909, the weekly records of mortality having been as follows :—

| | | | | | |
|---|---|---|---|---|---|
| Week ending | January | 2 | .. | 28 | deaths |
| ,, ,, | ,, | 9 | .. | 31 | ,, |
| ,, ,, | ,, | 16 | .. | 107 | ,, |
| ,, ,, | ,, | 23 | .. | 98 | ,, |
| ,, ,, | ,, | 30 | .. | 83 | ,, |
| ,, ,, | February | 6 | .. | 202 | ,, |
| ,, ,, | ,, | 13 | .. | 171 | ,, |
| ,, ,, | ,, | 20 | .. | 146 | ,, |
| ,, ,, | ,, | 27 | .. | 332 | ,, |
| ,, ,, | March | 6 | .. | 345 | ,, |
| ,, ,, | ,, | 13 | .. | 264 | ,, |
| ,, ,, | ,, | 20 | .. | 305 | ,, |
| ,, ,, | ,, | 27 | .. | 446 | ,, |
| ,, ,, | April | 3 | .. | 281 | ,, |
| ,, ,, | ,, | 10 | .. | 197 | ,, |
| ,, ,, | ,, | 17 | .. | 171 | ,, |
| ,, ,, | ,, | 24 | .. | 131 | ,, |

Similar fluctuations in the weekly increase of small-pox have been noticed in previous epidemics. Although all parts of the city have been affected, the northern half, and more especially the northern wards, have suffered most severely.

The Health Department of the Corporation was fully prepared for the emergency, and a large supply of excellent lymph was in stock, sufficient for all possible contingencies. The rapid development of the epidemic in February kept the staff of vaccinators fully engaged.

The necessity of isolating a patient and the great danger of a case in an overcrowded house are obvious. The necessity of isolating mild cases and of maintaining isolation in all cases until the dangers of infection are over, are not, however, sufficiently recognized.

**Colonial Medical Reports.—No. 3.—Calcutta**—(*continued*).

At the present time the provision for dealing with cases of infectious disease is as follows:—

(*a*) *For European patients*—

(1) Presidency General Hospital—has accommodation for all cases other than small-pox.

| | | |
|---|---|---|
| Cholera block .. | .. | 5 beds. |
| Plague hut .. | .. | 4 ,, |
| Measles block .. | .. | 16 ,, (also used for mumps and chicken-pox). |
| Diphtheria block | .. | 3 ,, |
| Observation ,, | .. | 6 ,, |

Cases of typhoid are treated in the general wards and private rooms.

(2) Campbell Hospital for small-pox only—block kept exclusively for European patients.

(*b*) *For Native patients*—

(1) Campbell Hospital—admits cases of all kinds of infectious disease, those suffering from plague, cholera and small-pox being treated in special wards.

(2) Medical College Hospital—admits cases of cholera, measles, diphtheria and whooping cough.

(3) Sambhu Nath Pandit Hospital—cases of cholera in a doubtful condition or whose condition does not permit of refusal. Also cases of diphtheriaand cerebro-spinal meningitis.

(4) Mayo Native Hospital—cholera cases only.

The Campbell Hospital is the only hospital that has provision for small-pox cases, and the accommodation for cholera patients at the Medical College and Mayo Hospitals is limited.

The following figures show that primary vaccination has been properly attended to:—

| | | |
|---|---|---|
| 1904 | .. | 20,544 |
| 1905 | .. | 19,701 |
| 1906 | .. | 27,038 (epidemic year). |
| 1907 | .. | 23,475 (small-pox also prevalent) |
| 1908 | .. | 23,291 (moderate amount of small-pox). |

Re-vaccinations depend largely upon the amount of small-pox prevailing. This in 1908 was of moderate intensity, and the re-vaccinations (6,470) were naturally much smaller than in the two previous years.

Some comments having been made in the General Committee on the small amount of fines realised (Rs. 31 only) as the result of prosecutions against parents and guardians.

It is only found necessary to prosecute in a few cases, because it is generally sufficient to issue the formal notice of the Vaccination Act and all requirements are satisfied.

The returns of vaccination show that the amount of fines realised is quite independent of the general manner in which the Vaccination Act is worked.

The amount of vaccination carried out in the different districts varies each year. In districts I. and II. there was a falling-off last year of 702, also a falling-off in district IV. of 131, whilst in district III. there was an increase of 653.

The primary vaccinations for the whole city were 23,291, as compared with 23,475 for 1907, a difference of only 134, notwithstanding that the past year had a small amount of small-pox.

I may mention that the total of primary vaccinations for the City of Bombay, with an approximately equal population to that of Calcutta, was, in 1907, only 17,486, as compared with the Calcutta figures of 23,475.

### The Animal Vaccine Depot.

The work here has continued satisfactorily.

From tests made, the superintendent states that the quality of the lymph prepared during 1908 was better than in any previous year since the depôt was established.

A slight attack of foot-and-mouth disease occurred in January, 1908, but, on the affected calves being isolated, there was no further outbreak.

*The Death-rates from Small-pox during the recent Out-break.*—From January 1 to April 30, 1909, there were recorded for the whole city 3,373 deaths from small-pox, but what the total number of cases was it is impossible to ascertain, so many—especially mild cases—being unreported.

It is curious to note that of the cases admitted to hospital the unprotected were about half the vaccinated in number, whereas in the larger returns collected by the Health Department for the whole city the number of deaths which occurred among the unprotected was 1,804, as against 1,446 among the vaccinated.

*Measles.*—The total number of deaths from this disease was 220—a considerable increase over that of previous years. It is impossible to say how many cases this mortality represents, as cases are so inadequately reported.

*Plague.*—The number of deaths (1,779) from the disease in 1908 was less than that of any year since 1899. The annual recrudescence was exceptionally mild; it developed more gradually than usual and attained a low maximum in the beginning of April, but declined more slowly.

Inoculation has been offered, but few persons choose to take advantage of it.

*Malaria.*—For the whole year 1,533 deaths were returned as due to Malaria. This compares favourably with 1,808 in the previous year. As pointed out in my last report, the comparative freedom of the old town (Urban Calcutta) is remarkable. The death-rate for Urban Calcutta was only 1·2 per 1,000 as compared with 2·9 for the Suburban Wards. The Fringe Area, however, seems to suffer still more severely—the rate for this being 3·3 per 1,000.

*Enteric Fever (Typhoid).*—There is reason to believe that this disease is much more common than our statistics indicate. It is probable that a considerable number of deaths put down to "other fevers" were really enteric, but only 142 deaths were definitely reported as due to this disease.

*Dysentery and Diarrhœa.*—These diseases are linked together, as it is difficult without medical certificates to satisfactorily distinguish them. The total of deaths was 2,312, but we have had recorded out of this total 1,677 deaths as ascribed to dysentery. Dysentery is apparently a more common disease amongst Hindus than in other classes, and the same remark applies to diarrhœa in its various forms.

*Tubercle.*—There were 2,101 deaths returned as due to tubercle, of which 2,049 were ascribed to phthisis and 52 to other forms of tuberculosis. The

rate is 2·5 per 1,000 of the population. In England the rate is 1·9 per 1,000. This is about the same as for the past four years. The rate in the Indian Army is ·52 per 1,000 but in the jail population of India it reaches 3·2 per 1,000. The rate for males in Calcutta is only 2·0, while that for females is 3·3 per 1,000.

The severe incidence of the disease amongst Mahomedan women is very striking—the rate amongst them being 5·8 per 1,000, whilst among Hindu females it is only 3 per 1,000.

The varying incidence of phthisis in the several wards of the city seems to depend upon the different constitutions of the populations in the several wards. Where we have large Mahomedan populations, the phthisis rate is high, because the female death-rates in these wards are so excessive. In other wards the phthisis rate is low, either because there is an enormous excess of males or because there are comparatively few Mahomedans. Phthisis is a disease largely dependent upon the sanitary condition of the home, and so long as the vast majority of the houses in Calcutta remain in their present state, we shall have little hope of affecting the prevalence of the disease.

*Diphtheria.*—This is another disease which is probably more prevalent than our statistics indicate. The deaths during 1908 were only thirty-four, twenty eight of which were in the northern half of the city, but even this is about double the number recorded in the two previous years. No less than thirty-one out of the total occurred amongst Hindus.

So-called "Remittent Fever" caused 982 deaths, but this heading covers several distinct diseases.

*Acute Pneumonia.*—Accounted for 904 deaths, a large number for this disease. This mortality is additional to the large number of deaths from acute and chronic bronchitis (3,505) and from bronchopneumonia (516). The disease is generally recognized as an acute specific fever and it is therefore classified apart from other affections of the lungs. Though occurring throughout the year, it is more prevalent at certain seasons. Here again Hindus would seem to suffer out of proportion to other classes.

*Tetanus.*—Is entered with 797 deaths. These occurred chiefly in new-born infants. The disease known as "idiopathic tetanus" occurs amongst adults, however, somewhat frequently. Its origin is not satisfactorily known.

*Puerperal Diseases.*—Must be considered as far more prevalent than they should be and the return of 475 deaths in connection with child-birth is lamentable.

### The Puerperal Diarrhœa of Bengal, otherwise known as "Sutika."

In my report on plague in Calcutta for 1904-05, I referred to a form of chronic diarrhœa with fever occurring in puerperal women, which caused a considerable number of deaths. Subsequent investigations have shown that the mortality from this disease is larger than was at first reported. For the year 1906-07 we have records in Calcutta of 228 deaths from "sutika," 196 from puerperal fever, and eighty from child-birth.

We have a large number of deaths amongst women after child-birth, amounting to over 1·3 per cent. on the total number of registered births, due to a disease characterised by the following symptoms, diarrhœa generally commencing within two or three weeks after delivery, but sometimes later, without blood or mucus in the stools, unaccompanied by any pain in the majority of cases. The stools vary from five to fifteen a day and are sometimes described as watery in character, at other times as frothy and fermenting. In some cases dyspeptic symptoms are noticed and in nearly all there is loss of appetite. There is no vomiting or cough and there are no symptoms pointing to pelvic mischief. Along with this diarrhœa is an irregular fever, but details concerning it are wanting, except that it commences the illness and seems to last throughout it. Debility and emaciation seem to occur early and exhaustion seems to be the final cause of death. A late symptom is œdema of the feet, which seems to occur in a large proportion of cases. The negative symptoms are important. There is no vaginal discharge or other sign of pelvic disease, there is no griping or tenderness of the abdomen (except in a few cases), and no vomiting. The previous state of health is reported as having been good in the majority of instances. The course varies. Sometimes it seems rapid, the symptoms are more intense, and the patient dies within a few months. In other cases the illness drags on for over twelve months. The average is from five to eight months. What the case mortality is I have no means of knowing. The disease seems to occur in women of all ages and equally amongst Hindus and Mahomedans The following table shows this:—

Deaths from "Sutika," 1906-07.

| Age | Hindus | Mahomedans | Total |
|---|---|---|---|
| Under 15 | 2 | 1 | 3 |
| 15 to 19 | 27 | 12 | 39 |
| 20 to 24 | 35 | 16 | 51 |
| 25 to 29 | 39 | 21 | 60 |
| 30 to 34 | 32 | 11 | 43 |
| 35 to 39 | 14 | 5 | 19 |
| 40 and over | 8 | 5 | 13 |
| Total | 157 | 71 | 228 |

In the Calcutta population Hindus are in proportion to Mahomedans as two to one. Compare these figures with those for:

Deaths from Puerperal Fever, Calcutta, 1906-07.

| Age | Hindus | Mahomedans | Total |
|---|---|---|---|
| Under 15 | 8 | 2 | 10 |
| 15 to 19 | 27 | 15 | 42 |
| 20 to 24 | 34 | 19 | 53 |
| 25 to 29 | 23 | 21 | 44 |
| 30 to 34 | 22 | 10 | 30 |
| 35 to 39 | 4 | 3 | 7 |
| 40 and over | 4 | 4 | 8 |
| Total | 122 | 74 | 196 |

This gives a death-rate of 1·2 per cent. in addition to the rate from "sutika." The deaths connected with child-birth due to other causes amounted to ninety, so that apart from this ill-understood disease "sutika," child-birth in this city is accompanied with a death-rate of 1·7 per cent. The disease is recognized by some of the native practitioners, but its cause is unknown. I have not heard of any case amongst Europeans. Practitioners in other parts of Bengal inform me that it occurs in several other towns. The diagnosis seems fairly clear, but the pathology is a

mystery. It is certainly not ordinary puerperal fever, it is equally certain that it is not dysentery, and there is no indication that it is due to tubercle. As health officer I have no opportunity of studying these cases clinically nor with regard to treatment, and I therefore publish this note solely as a small epidemiological study.

For 1908 there were 165 deaths returned as due to this disease, distributed thus: Hindus 105, Mahomedans sixty. This is approximately in correspondence with their respective populations.

*The Laboratory.*—With the appointment of an additional assistant a much larger amount of work has been got through. This especially applies to the examination of food-stuffs, to which particular attention has been given.

*Milk.*—394 samples analysed, as against 262 in the previous year. In addition, the sediment of 160 samples was examined bacteriologically. *Ghee.*—372 samples as against 344 last year, but 144 samples of sweetmeats were also examined for the detection of the use of adulterated ghee. *Butter.*—40 samples as against 30. *Mustard Oil.*—103 samples examined as against 25. *Sago.*—47 as against 34. *Aerated Waters.*—11 samples. *Filtered Water Supply.*—49 samples of Hooghli river water from the intake at Pulta, and 49 samples of water from the settling tanks at Pulta, and 53 samples of filtered water taken from the different reservoirs in the city, were examined during the year. Like all previous years the "total solids" were found to range high from January to June, varying during this period from 16·5 to 57·5 parts per 100,000. This unprecedented increase in the total solids, showing the maximum of 57·5 parts in May, was mainly due to the increase in the chlorides in the water, owing to the tidal current bringing in sea water up to Pulta. With the setting in of the rains the total solids rapidly diminished, reaching the minimum of 8·4 and maximum of 9·0 parts in September. From this time onward, the solids gradually increased, till it reached the figure 23·5 in the last week of December.

The amount of chlorine as dissolved chlorides ranged from 0·4 part to 16·0 parts per 100,000. It was highest in May and lowest in September. This abnormal increase in the amount of chlorine is a record in the history of the water-supply of Calcutta, and if it repeats itself it might become a matter for consideration whether the intake at Pulta should not be removed further up, beyond the reach of the tides.

The amount of "albuminoid ammonia" as determined by Wanklyn's process varied from 0·0024 to 0·0072 part per 100,000. The average of the maximum figures from January to June amounted to 0·0057, while from July to December it averaged 0·0049 part per 100,000. The amount of "oxygen consumed" varied from 0·005 to 0·026, the average being ·010 part per 100,000. The "total hardness" varied with the solids. The amount ranged from 12·5 to 17·75 parts from January to June, and from 4 to 6·5 parts from July to the 1st week of November. Then it rose rapidly till, by the end of December, it reached 16·5 parts per 100,000. The "permanent hardness" varied slightly, ranging from 3·0 to 6·0 parts per 100,000. The water was invariably found to be free from nitrites, while "free ammonia" was found to be present in trace only on several occasions.

The treatment of the water with alumino-ferric was successfully employed during the rains, to remove the opalescence in the water due to the suspension of fine mineral particles. The only drawback to its use is the addition it makes of an extremely small amount of arsenic to the water. It is desirable that alumino-ferric freed from the soluble salts of arsenic should be obtained for use in future, if possible.

Bacteriological examinations of the filtered water as supplied to the city were made every week. In all the examinations *B. coli communis* were found to be present in 2 c.c., and even sometimes in 1 c.c. or less of water but neither *cholera vibro* nor *B. typhosus* were ever detected.

The filter beds at Pulta were examined once every week and the number of colonies determined, to show their efficiency or otherwise in filtration. It has been observed that no relation could be established between the head of water, the number of days the filters had been at work, and the number of colonies of bacteria found.

*Effect of Storage of Water on the Number of Microbes.*—In his first report on research work, Dr. Houstan, the Director of Water Examination, Metropolitan Water Board, London, has emphasized the great importance of storing water antecedent to filtration in effecting a large percentage of reduction in the total number of bacteria originally present in the water, and he concluded by saying that "storage should not be looked upon from the limited point of view of mere mechanical sedimentation; storage means something far more than this: it means, among other things, the ultimate death of the microbes causing epidemic disease." An experiment was undertaken in the laboratory to see whether similar results could be obtained. For this purpose, the Hooghli water was obtained from the bathing ghats near Calcutta and from mid-stream. In all ten samples were collected during October, November, and December; the samples were put into a glass trough and kept in the laboratory, with a covering to prevent dust falling on it. It may be well to point out the immense numbers of microbes found in the River Hooghli water at the time the experiments were made—numbers far higher, as far as we are aware, than have been recorded elsewhere.

The experiment, so far, fully corroborates the results obtained by Dr. Houstan. It is satisfactory to know that the Hooghli river water is always stored antecedent to filtration—the time varying from thirty-three and a quarter hours to sixty hours. It is desirable, however, that it should be stored at least a week, so that pathogenic microbes may die out a natural death.

One hundred and eighty-six other samples of water were examined for the presence of *cholera vibro;* in eight samples of Tolly's Nullah water and tank waters this organism was found.

*Other Bacteriological Examinations.*—Ten samples of blood were examined—of these nine for Widal's reaction for typhoid, two showing positive results. The remaining one showed malarial parasite (benign tertian). Four samples of sputum were examined,

two showing tubercle bacilli; 8 samples of meat were examined for parasites. Sediments from 160 samples of milk brought by the Food Inspectors were examined, but in only 2 were acid-fast bacilli found. The vaccine lymph as issued by the Department was examined from time to time, and was found to be satisfactory.

Forty special samples of mustard oil from the different mills and retail shops were obtained and examined. In the case of adulterated articles, the vendors were prosecuted in the majority of cases.

The amount of adulteration in the several articles varied greatly.

### Water Supply.

In order to ensure the purity of the filtered water supply, regular analyses and bacteriological examinations of water taken from the several pumping stations were undertaken, and in addition samples of water from each of the filter beds were examined each week for the estimation of the numbers of microbes.

During the dry season of the year I had occasion to report to the General Committee on the unusual character of the water.

*Ærated Water Factories.*—As a result of enquiries and inspection of these factories it was found (in the middle of 1908) that there was a total of 52.

The larger manufacturers of ærated water have satisfactory premises and the processes employed ensure purity, but the same cannot be said of the similar places which have so increased in number during the past few years. I endeavoured to get all these places under license, but the law is reported against me.

### The Protection of the Food Supply.

That some improvement has been effected in the quality of the food supply during the past few years must, I think, be admitted. By improvement is meant that there is less food now exposed for sale which is unfit for consumption. We have no control over quality, in the ordinary sense of the word. In dealing with ærated waters I drew attention to our almost helpless condition in consequence of the state of the law, and I regret to report that the ingenuity of the shopkeeper has largely succeeded in overcoming our action with regard to adulteration. This offence having been declared permissible, that is to say, adulteration alone not being punishable so long as it can be shown the customer is not cheated, there has grown up the trick of announcing on a notice-board that the pure article is not sold. The public know that they are buying an adulterated article, but accept the situation without demur.

During the past year the following amounts of food-stuffs have been destroyed by the Food Inspectors:—

| Milk | Ghee | Butter | Vegetables and Fruits | Sweetmeats | Fish |
|---|---|---|---|---|---|
| 664 mds. | 105 mds. | 5 mds. | 438 mds. | 52 mds. | 542 mds. |

| Grains | Meat | Mustard oil | Flour | Medicines |
|---|---|---|---|---|
| 790 mds. | 10 mds.[1] | 10 mds. | 97 mds. | 80 lbs. |

In addition to these, there were 46 tins of condensed milk and 264 tins of meat destroyed.

That the officers of the Department have been active is borne out by the following table, showing samples taken:—

[1] This does not include the meat condemned and destroyed at the several slaughter-houses.

| | 1908 | 1907 |
|---|---|---|
| Milk | 380 | 263 |
| Ghee | 346 | 341 |
| Mustard oil and mixed oil | 103 | 23 |
| Butter | 35 | 23 |
| Flour | 5 | 23 |
| Arrowroot | 10 | 61 |
| Sago | 25 | 16 |
| Sweetmeats | 111 | 9 |

The total number of samples of all kinds taken amounted to 1,102 as against 838 in the previous year, the increase being distributed over all the districts.

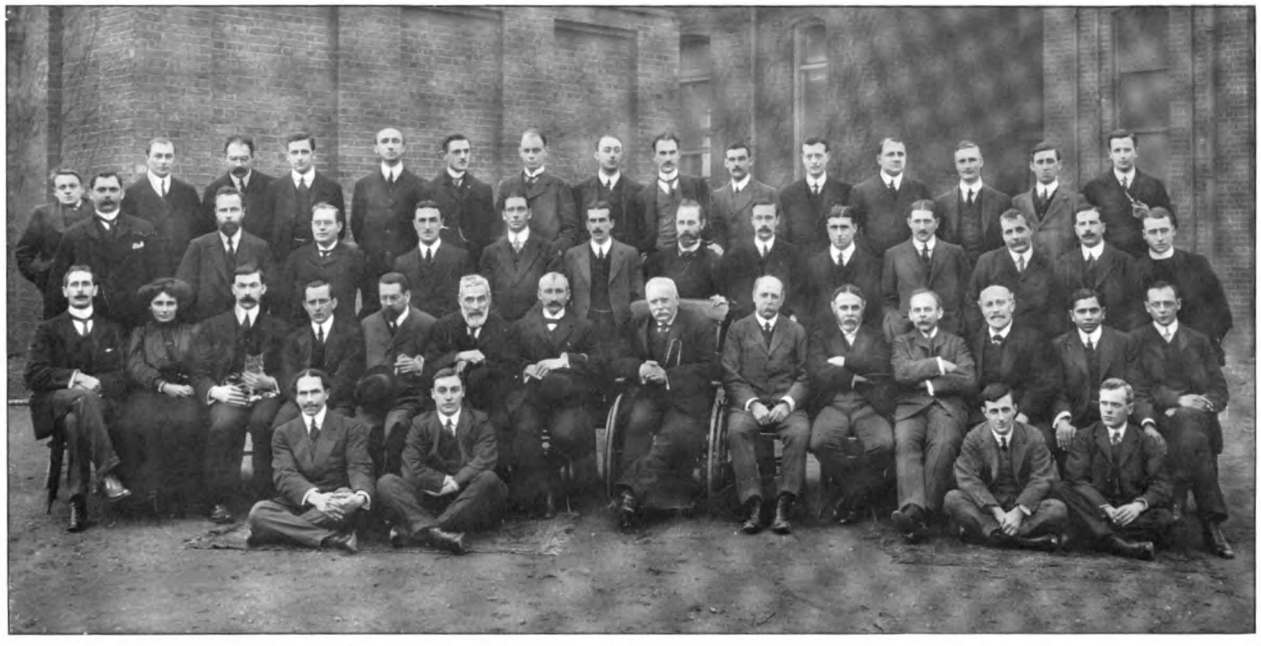
*Protection of Meat Supply.*—With regard to the inspection of meat in general I may state animals brought for slaughter at Tangra are first examined by the Veterinary Inspector. Those unfit are rejected. The carcases are subsequently inspected by the Veterinary Inspector and by the Superintendent, and unfit portions are destroyed. After arrival at the New Market the meat is further inspected by the Food Inspector and by the Superintendent, and if any portions be found unfit they are destroyed. Doubtful pieces are submitted for my decision and I have the laboratory for chemical, microscopical and bacteriological investigations at my command.

The work of the Inspectors of meat shops consists in seeing that the meat shops are kept in a sanitary condition, that the butchers take out the necessary licenses, and that the meat sold is fit for consumption. In addition they have to prosecute for illicit slaughtering and make endeavour to discover cases of flaying goats alive.

*The Milk Supply.*—Some improvement has been shown in the quality of milk sold in most parts of the city. In the New Market a much higher standard has been maintained. Large quantities of adulterated milk brought into the city in bulk have been destroyed, averaging 2 maunds a day, and 380 samples of doubtful quality have been taken for analysis (see laboratory report). Of these, 319 were found to be adulterated and prosecutions were instituted in the majority of cases. The adulterant almost invariably used is water, but occasionally sugar is used, and in addition to the fraud there is the danger that dirty water may be added. In private houses the milk supply is often watered by the servants. The proposal for the municipal cowshed has at last taken shape. The sum of Rs. 25,000 has been budgetted and the Corporation have decided to acquire two bighas of land in Nundo Lal Bose Lane, and to construct a model cowshed with accommodation for 50 cows. Municipal cowsheds have been in existence for some time in Bombay and provide sanitary quarters for a large number of animals. They are, I understand, financially a success. My original proposal in 1904 was for sanitary cowsheds to be provided by the Corporation with stalls let out in a similar way to the stalls in the New Market, the Corporation providing for maintenance of the building, for cleansing, and for the necessary supply of water. The *gowala* would then be able to carry on his business in his own way, subject, of course, to certain rules and regulations concerning the maintenance of order and his proper conduct in the building. The whole object of the scheme is to provide sanitary sheds and thereby to get rid of some of the filthy kutcha structures in the northern half of the city.

## LONDON SCHOOL OF TROPICAL MEDICINE.

**35th Session. January-April, 1911.**



*Back Row* (*Left to Right*)—Robert (2nd Laboratory Assistant), G. R. H. Chell, J. Martinez Santamaria, F. Standish, W. H. Jeffreys, E. E. Witt, W. H. Scott, W. M. Wade, G. N. Palmaer, C. C. Shaw (Captain I.M.S.), H. Crossle (Captain I.M.S.), G. B. Warren (1st Laboratory Assistant), S. Hunt (Major I.M.S.), J. B. Alexander, H. M. Hanschell.

*Second Row.*—H. A. Foy, G. W. Uytenhondt, J. C. Cotton, E. J. Wyler, C. J. Wilson, H. S. Coghill (Senior Demonstrator), M. des Ligneris, G. G. Butler, A. J. R. O'Brien, A. F. Kennedy, C. Milne (Major I.M.S.), J. P. Cameron (Captain I.M.S.), Rev. F. Wells.

*Third Row* (*Sitting*)—H. B. Newham (Director), Miss Summers (Entomological Assistant), A. Hutton (Junior Demonstrator), Dr. G. C. Low (Lecturer), M. Pierre Du Pasquier (of Geneva), F. Swanzy, Esq. (Member of Committee), Dr. Eugene Patry (of Geneva), Sir P. Manson, K.C.M.G. (Lecturer), P. Michelli, Esq., C.M.G. (Secretary), Dr. C. W. Daniels (Lecturer), Colonel A. Alcock, F.R.S. (Arthropodist), Mr. J. Cantlie (Lecturer), J. F. Valladares, M. B. Hay.

*Front Row.*—M. W. Morrison, K. B. Allan (Junior House Surgeon), A. J. M. Crichton, F. M. Longson.

*Absent.*—Dr. R. T. Leiper (Helminthologist), Dr. C. M. Wenyon (Protozoologist), R. S. Roper (Senior House Surgeon), D. P. Williams, S. B. Surty, C. F. Nicholas, C. A. Lane (Major I.M.S.), J. Pool, U. Graham Smith, H. R. Morehead.

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**LECTURES AND DEMONSTRATIONS DAILY BY MEMBERS OF THE STAFF.**

There are three Sessions yearly of three months each, viz., from October 1st to December 31st, from January 15th to April 14th, and from May 1st to July 31st inclusive. Women Graduates are received as Students.

Certificates are granted after Examination at the end of each Session, and the course is accepted by Cambridge University as Qualifying for Admission to their Examination for the Diploma in Tropical Medicine and Hygiene, and by London University as Study for the M.D. in Branch VI. (Tropical Medicine).

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Students can be provided with Board and Residence, or partial Board, at the School.

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A syllabus, with the general course of study, can be had on application to the undersigned, from whom further information may be obtained.

Students of the London School of Tropical Medicine, who join the London School of Clinical Medicine, will be allowed an abatement on their fees and *vice versâ*.

*Chief Office*—SEAMEN'S HOSPITAL, GREENWICH, S.E.

Mac

**Colonial Medical Reports.—No. 3.—Calcutta**—(*continued*).

### Cruelty to Cows.

The question of cruelty to animals in licensed cowhouses and cattle sheds was brought to the notice of the chairman by a note of the President of the Society for the Prevention of Cruelty to Animals. The note pointed out the prevailing insanitary conditions of these places, mentioning specific cases and suggesting the provision of a model cowhouse and other general remedial measures. The specific cases complained of were enquired into, and it was found that action was being taken in most of them. But it was with the question generally considered that the note was concerned; and in the reply of the Chairman it was stated among other things that the provision of a model cowhouse was under consideration. At present a site is being selected for the purpose. The bye-laws under consideration are also expected to give power for the removal of some insanitary conditions.

### Dangers of Certain Imported Tinned Foods.

Large quantities of skimmed milk are imported without there being any or sufficient indication on the cases or on the tins that the milk is skimmed. This material is made from milk from which the fat has been abstracted, and there is frequently more or less sugar added as a substitute. Besides being a fraud on the public, I have no hesitation in stating that such milk is of inferior quality, and injurious to the public health if sold as condensed pure milk. It is especially injurious when sold for infants, as the food fat of milk is a most essential component of milk as food for infants.

Tinned meats are imported in every variety of condition. Sometimes the tins show manifest signs of decomposition of the contents by having become "blown." At others though the tins appear to external appearances sound, they contain mouldy, sour, or otherwise changed contents. In a third class "blown" tins are drilled to let out the contained gas, and are then soldered up again. In nearly all instances the tins are old, and the point I would urge is that each tin should bear the date at which it left the manufactory.

My proposal has for its object to facilitate the inspection and examination of tinned meats and to inhibit the sale of old stock, thereby assisting to protect to a certain extent the public health.

### Work of the Sanitary Inspectors.

The total number of notices issued under the various "Health" sections of the Act was 4,431, as compared with 3,535 in the previous year. Of this number 2,842 were complied with, and in 746 the requirements at the end of the year were being carried out. This record compares favourably with previous years.

*Conversion of service privies* into connected ones has been actively pushed—591 being reported as completed during the year, with 169 others in progress. These figures are nearly double those of the previous year.

*House drainage* has had particular attention, and no less than 1,424 cases were completed, with 225 others reported as in progress; 80 wells were filled up, with 15 others in progress; 59 tanks were filled up, and the work with 58 others was in progress.

Forty-one *Cattle sheds and* 35 *Stables* were improved; with 39 and 22 others respectively, reported as in progress.

### The Sanitary Condition of the Public and other Schools in Calcutta.

In 1905, when Acting Health Officer, I caused all the public school premises to be inspected with regard to their sanitary condition. Many and serious defects were discovered. My report was submitted to Government, and as a consequence, the schools were inspected by the Assistant Inspector of Schools, and a full report on the sanitary condition of each school was submitted to the Director of Public Instruction. Orders have since been passed. The University will take the necessary steps with regard to the unaided high English schools, and Government will take action for high English aided schools. For middle schools, most of which are aided, the managers will be called upon to make improvements. For primary and miscellaneous schools, the chief defects in which refer to absence of, or insanitary condition of, privies and urinals, the Health Department has taken action. In many cases, however, *gurus* are not the owners of the school properties, and poverty prevents many required improvements. With regard to lighting, ventilation, and over-crowding, the co-operation of the Education Department is necessary. A complete list of all the schools was supplied during the year to each District Health Officer, who was also given instructions to take up the case of each primary or other school separately.

*Instruction of the Staff.*—During the year the following lectures have been given: "Offensive Trades," by Dr. R. Sen; "Drainage," by Dr. A. T. Mookerjee; "Immunity," by Dr. Crake; "Disposal of the Dead," by the Health Officer; "Infectious Diseases," by Dr. S. C. Banerjee; "Chemical Tests and Microscopical Specimens," by Dr. J. N. Dutt; "Water Supply System of Calcutta," by A. Pierce, Esq.

Visits were made by the staff of the Department to the Pulta water-works and to the municipal laboratory, at both of which places demonstrations were given on the working of these instructions.

*Disinfecting Station.*—This station is only used for the disinfection of bedding and clothing, as all palkis, gharis, &c., for conveying infectious cases to hospitals are disinfected by the hospital authorities. The

| | | | |
|---|---|---|---|
| January | 5 | July | 2 |
| February | 6 | August | 2 |
| March | 7 | September | 4 |
| April | 13 | October | 9 |
| May | 9 | November | 2 |
| June | 2 | December | 6 |
| | Total 67 | | |

majority of infectious cases occur amongst the poor, and not being otherwise notified, we only hear of a certain number, chiefly through the death lists. On

inquiry of deaths, it is generally found that the clothing or bedding of the deceased has disappeared. These facts explain the small amount of work done at the station.

The apparatus at the station is in good working order and the process of steam disinfection is conducted satisfactorily.

*The Dhobikhanas.*—Both the Dhobikhanas have been well patronised, all the "stones" being fully occupied throughout the whole year.

In the North Dhobikhana ten additional "stones" are under construction. It is contemplated to remove the South Dhobikhana to a larger site and to increase considerably the number of stones.

### Disposal of the Dead.

Many of the Calcutta dead are taken beyond municipal limits for disposal, 932 bodies being known to have been taken during 1908 to the burning ghats and burial grounds in the suburbs.

Amongst this number (932) we have information that 35 died from plague, 143 from cholera, 35 from small-pox and 2 from measles.

On the other hand, a very large number of the suburban dead (3,745) are brought into Calcutta for disposal.

During the year four old burial grounds have been duly registered, and plans of them have been deposited in the office. Six burial grounds have been closed.

At the Crematorium there were only five cremations. It is estimated that about 6,000 cubic feet of gas are consumed for each cremation. All the bodies were brought in coffins, which were burnt along with the bodies.

The total number of cremations in the city was 18,000, and the total number of burials was 12,519.

### Suggested Sanitary Reforms.

Of the sanitary reforms referred to in my previous report as urgently called for, I have the satisfaction of recording that considerable progress has been made in the directions indicated.

*Total Births in Calcutta*—17,043.

*Total Deaths from all Causes*—27,689.

Deaths from the diseases named were registered as follows:—Cholera, 3,694; small-pox, 578; measles, 220; plague, 1,779; malaria, 1,533; enteric fever, 142; "other fevers," 1,322; dysentery and diarrhœa, 2,312; tubercle, 2,101; respiratory diseases, excluding tubercle of the lung, 5,156; injuries, 538; diphtheria, 34; other causes, 8,314.

## Colonial Medical Reports.—No. 4.—Federated Malay States.

### State of Perak.

# MEDICAL REPORT FOR THE YEAR 1909.

**By W. B. ORME.**

*Acting Senior Medical Officer, Perak.*

### Statistics of Population.

As has frequently been pointed out, these statistics are merely approximate, the ingress and egress by the railway being completely left out of account. For the year 1908 the total population was estimated as 405,093, and for the year under review, 396,057, being a reduction of 9,036. This is due to several factors, among which are the great excess of deaths over births amongst Chinese and Tamils, as is unfortunately usual, combined with the excess of emigrants over immigrants, which in the case of the Chinese has no doubt been influenced by the fall in the price of tin. It is a pleasing feature to note that the number of the Malays seems to steadily increase.

The population returns for 1909 show an increase among Europeans and Eurasians of 13, and Malays of 3,247, but a decrease of 10,364 Chinese and 1,931 Tamils.

*Births.*—The number registered during the year was 9,506, being a decrease over 1908 of 84.

The birth-rate per mille during 1904 was 24; the figures for last year being 23·67.

*Deaths.*—The number registered during the year was 12,678, being a decrease of 3,003 over 1908.

The death-rate per mille during 1909 was 32·01 against 38·70 recorded for the previous year. This reduction in the mortality was chiefly amongst the Chinese.

### Medical Institutions.

(*a*) On December 31, 1908, there remained 1,984 patients in the nineteen hospitals (the Malay hospital at Kuala Kangsar not having been occupied at that date.)

(*b*) During the year the admissions for the twenty institutions (Malay hospital having been opened on February 16) amounted to 31,741, the figures for 1908 being 33,594.

(*c*) The total treated was, therefore, 33,725 against 35,595 for the previous year.

(*d*) The number discharged (including those who absconded) was 28,442 against 28,332 the year before.

(*e*) Two hundred and forty patients were transferred—being either sent to Pulau Jerejak and Pulau Pangkor Laut, or overflows from crowded hospitals.

(*f*) Three thousand and seventy-seven deaths occurred compared with 4,868 for the previous year, a decrease of no less than 1,791. Six hundred and sixty of these deaths took place within forty-eight hours of admission.

The percentage of deaths to the total treated was 9·12 as compared with 13·68 for 1908. I would particularly draw attention to the fact that for the past twenty-three years no such record has been achieved,

RETURN OF DISEASES AND DEATHS IN 1909 AT THE FOLLOWING INSTITUTIONS:—

**Fourteen District Hospitals, at Taiping Kuala Kangsar, Batu Gajah, Gopeng, Ipoh, Kampar, Telok Anson, Tapah, Parit Buntar, Bagan Serai, Selama, Lenggong, Tanjong Malim and Grit; one Malay Hospital, at Kuala Kangsar; two Gaol Hospitals, at Taiping and Batu Gajah; one Lunatic Asylum, at Taiping; two Leper Asylums, at Pulau Jerejak and Pulau Pangkor Laut.**

## GENERAL DISEASES.

| | Admissions | Deaths | Total Cases Treated |
|---|---|---|---|
| Alcoholism | 8 | — | 8 |
| Anæmia | 330 | 36 | 346 |
| Anthrax | — | — | — |
| Beri-beri | 1413 | 184 | 1778 |
| Bilharziosis | — | — | — |
| Blackwater Fever | — | — | — |
| Chicken-pox | 24 | — | 24 |
| Cholera | — | — | — |
| Choleraic Diarrhœa | — | — | — |
| Congenital Malformation | — | — | — |
| Debility | 452 | 58 | 479 |
| Delirium Tremens | 2 | — | 2 |
| Dengue | 3 | — | 3 |
| Diabetes Mellitus | 2 | 1 | 2 |
| Diabetes Insipidus | — | — | — |
| Diphtheria | — | — | — |
| Dysentery | 2958 | 769 | 3100 |
| Enteric Fever | 32 | 9 | 35 |
| Erysipelas | 29 | 7 | 29 |
| Febricula | 2 | — | 2 |
| Filariasis | — | — | — |
| Gonorrhœa | 535 | 6 | 551 |
| Gout | — | — | — |
| Hydrophobia | — | — | — |
| Influenza | 2 | — | 2 |
| Kala-azar | — | — | — |
| Leprosy | 271 | 62 | 448 |
| (*a*) Nodular | — | — | — |
| (*b*) Anæsthetic | — | — | — |
| (*c*) Mixed | — | — | — |
| Malarial Fever— | — | — | — |
| (*a*) Intermittent | — | — | — |
| Quotidian | 502 | 4 | 535 |
| Tertian | 3113 | 115 | 3163 |
| Quartan | 273 | 18 | 284 |
| Irregular | 14 | — | 14 |
| Type undiagnosed | 2085 | 70 | 2147 |
| (*b*) Remittent | 51 | 9 | 53 |
| (*c*) Pernicious | 1197 | 210 | 1208 |
| (*d*) Malarial Cachexia | — | — | — |
| Malta Fever | — | — | — |
| Measles | 1 | — | 1 |
| Mumps | 6 | — | 6 |
| New Growths— | — | — | — |
| Non-malignant | 22 | 1 | 26 |
| Malignant | 34 | 17 | 35 |
| Old Age | — | — | — |
| Other Diseases | 138 | 8 | 146 |
| Pellagra | — | — | — |
| Plague | — | — | — |
| Pyæmia | 1 | 1 | 1 |
| Rachitis | — | — | — |
| Rheumatic Fever | 1 | — | 1 |
| Rheumatism | 236 | 3 | 242 |
| Rheumatoid Arthritis | — | — | — |
| Scarlet Fever | — | — | — |
| Scurvy | 1 | 1 | 1 |
| Septicæmia | 4 | 2 | 4 |
| Sleeping Sickness | — | — | — |
| Sloughing Phagedæna | 67 | 16 | 84 |
| Small-pox | — | — | — |
| Syphilis | — | — | — |
| (*a*) Primary | 153 | 2 | 167 |
| (*b*) Secondary | 1601 | 52 | 1671 |
| (*c*) Tertiary | — | — | — |
| (*d*) Congenital | 17 | 1 | 18 |
| Tetanus | 3 | 3 | 3 |
| Trypanosoma Fever | — | — | — |
| Tubercle— | 34 | 4 | 38 |
| (*a*) Phthisis Pulmonalis | — | — | — |
| (*b*) Tuberculosis of Glands | — | — | — |
| (*c*) Lupus | — | — | — |
| (*d*) Tabes Mesenterica | — | — | — |
| (*e*) Tuberculous Disease of Bones | — | — | — |
| Other Tubercular Diseases | — | — | — |
| Varicella | — | — | — |
| Whooping Cough | — | — | — |
| Yaws | 12 | — | 12 |
| Yellow Fever | — | — | — |

## LOCAL DISEASES.

| | Admissions | Deaths | Total Cases Treated |
|---|---|---|---|
| Diseases of the— | | | |
| Cellular Tissue | 743 | 34 | 779 |
| Circulatory System— | — | — | — |
| (*a*) Valvular Disease of Heart | 117 | 43 | 123 |
| (*b*) Other Diseases | 34 | 9 | 36 |
| Digestive System— | — | — | — |
| (*a*) Diarrhœa | 707 | 122 | 728 |
| (*b*) Hill Diarrhœa | — | — | — |
| (*c*) Hepatitis | 15 | 2 | 17 |
| Congestion of Liver | 3 | — | 3 |
| (*d*) Abscess of Liver | 13 | 8 | 15 |
| (*e*) Tropical Liver | — | — | — |
| (*f*) Jaundice, Catarrhal | 31 | 9 | 33 |
| (*g*) Cirrhosis of Liver | 92 | 43 | 95 |
| (*h*) Acute Yellow Atrophy | — | — | — |
| (*i*) Sprue | 8 | 4 | 9 |
| (*j*) Other Diseases | 949 | 75 | 974 |
| Ear | 54 | 1 | 54 |
| Eye | 393 | 4 | 424 |
| Generative System— | — | — | — |
| Male Organs | 551 | 11 | 577 |
| Female Organs | 123 | 6 | 144 |
| Lymphatic System | 466 | 7 | 487 |
| Mental Diseases | — | — | — |
| Nervous System | 472 | 78 | 629 |
| Nose | 12 | — | 12 |
| Organs of Locomotion | 287 | 15 | 304 |
| Respiratory System | 1797 | 593 | 1899 |
| Skin— | — | — | — |
| (*a*) Scabies | — | — | — |
| (*b*) Ringworm | — | — | — |
| (*c*) Tinea Imbricata | — | — | — |
| (*d*) Favus | — | — | — |
| (*e*) Eczema | 285 | 2 | 300 |
| (*f*) Other Diseases | 4720 | 78 | 5021 |
| Urinary System | 328 | 88 | 371 |
| Injuries, General, Local— | 2039 | 64 | 2064 |
| (*a*) Siriasis (Heatstroke) | — | — | — |
| (*b*) Sunstroke (Heat Prostration) | 1 | — | 1 |
| (*c*) Other Injuries | — | — | — |
| Parasites— | 365 | 6 | 376 |
| Ascaris lumbricoides | 204 | 2 | 208 |
| Oxyuris vermicularis | — | — | — |
| Dochmius duodenalis, or Ankylostoma duodenale | 789 | 96 | 817 |
| Dracunculus medinensis (Guinea-worm) | 12 | — | 12 |
| Tapeworm | 49 | — | 49 |
| Poisons— | — | — | — |
| Snake-bites | — | — | — |
| Corrosive Acids | — | — | — |
| Metallic Poisons | 6 | — | 6 |
| Vegetable Alkaloids | 11 | 4 | 11 |
| Nature Unknown | — | — | — |
| Other Poisons | 65 | 1 | 70 |
| *Surgical Operations*— | — | — | — |
| Amputations, Major | 105 | 3 | 110 |
| ,, Minor | | | |
| Other Operations | — | — | — |
| Eye | — | — | — |
| (*a*) Cataract | — | — | — |
| (*b*) Iridectomy | — | — | — |
| (*c*) Other Eye Operations | — | — | — |

this being the first time, during the above period, that the death-rate has not actually run into double figures. Be the explanation what it may, the result is most gratifying.

The following table is interesting :—

STATEMENT OF MORTALITY.

| Hospital | Deaths 1908 | Deaths 1909 | Percentage 1908 | Percentage 1909 |
|---|---|---|---|---|
| Taiping | 671 | 462 | 16·84 | 14·48 |
| Kuala Kangsar | 287 | 196 | 15·02 | 11·73 |
| ,, Malay Hospital | — | 10 | — | 3·38 |
| Batu Gajah | 593 | 328 | 14·91 | 9·44 |
| Gopeng | 367 | 204 | 15·08 | 8·91 |
| Ipoh | 1,104 | 681 | 17·18 | 10·73 |
| Kampar | 620 | 397 | 16·26 | 8·96 |
| Telok Anson | 175 | 128 | 7·82 | 6·41 |
| Tapah | 470 | 236 | 15·63 | 9·60 |
| Parit Buntar | 118 | 141 | 5·83 | 6·35 |
| Bagan Serai | 166 | 114 | 7·11 | 4·69 |
| Selama | 8 | 4 | 10·39 | 3·88 |
| Lenggong | 19 | 20 | 4·33 | 4·66 |
| Tanjong Malim | 69 | 41 | 8·42 | 5·10 |
| Grit | 38 | 12 | 11·45 | 3·49 |
| Convict Establishment | 18 | 10 | 3·17 | 1·40 |
| Batu Gajah Gaol | 14 | 6 | 1·99 | 1·53 |
| Lunatic Asylum | 88 | 43 | 29·33 | 13·10 |
| Pulau Jerejak | 38 | 42 | 23·75 | 18·18 |
| Pulau Pangkor Laut | 5 | 2 | 10·64 | 4·34 |
| | 4,868 | 3,077 | 13·68 | 9·12 |

The daily average of sick in the fifteen district hospitals was 1,531·76, being a slightly lower figure than that for 1908.

The number of the patients remaining on December 31, 1909, was 1,966.

### THE MALAY HOSPITAL.

This institution has proved an unqualified success, no less than 295 patients being treated during the 10½ months the institution has been opened.

His Highness the Sultan has from the first taken much interest in the hospital, and to him in great part is due its prosperity.

### GAOL HOSPITALS.

| Hospital | Total treated | Total deaths |
|---|---|---|
| Convict Establishment, Taiping, 1908 | 568 | 18 |
| ,, ,, 1909 | 712 | 10 |
| Batu Gajah Gaol, 1908 | 704 | 14 |
| ,, ,, 1909 | 390 | 6 |

The health of both these establishments shows improvement over the previous year.

At Batu Gajah there were but three admissions of beri-beri, and at the Convict Establishment six. Dr. Wood remarks that none of these latter contracted the disease in the gaol.

### LEPER ASYLUMS.

At Pulau Pangkor Laut forty-six lepers were treated during the year. There were two deaths, giving a death-rate of 4·34 per cent. as compared with 10·64 per cent. for 1908.

There were but seven admissions during the year, and it appears that many Malay lepers exist who elude certification.

At Pulau Jerejak 231 were treated, of which number nine absconded and forty-two died.

The death-rate was 18·18 per cent. as against 23·75 per cent. for 1908.

The number of Chinese lepers found in Perak has greatly increased, so much so that it has been necessary to provide for a new ward to be constructed in 1910.

### LUNATIC ASYLUM.

In spite of great overcrowding existing at the asylum the death-rate is the lowest for the past six years :—

| Year | Total treated | Discharged | Percentage of deaths |
|---|---|---|---|
| 1904 | 275 | 93 | 21·81 |
| 1905 | 270 | 78 | 14·81 |
| 1906 | 320 | 92 | 26·56 |
| 1907 | 313 | 106 | 18·84 |
| 1908 | 300 | 75 | 29·33 |
| 1909 | 328 | 117 | 13·10 |

Out of the forty-three deaths but one was due to beri-beri. And, at the time of writing, the institution is free from the disease.

### WOMEN'S HOSPITAL.

The number of patients in this institution has steadily fallen during the last five years as the figures below will show :—

| | Indoor | Outdoor |
|---|---|---|
| 1905 | 80 | 3,167 |
| 1906 | 69 | 2,091 |
| 1907 | 60 | 1,419 |
| 1908 | 26 | 742 |
| 1909 | 23 | 402 |

I most strongly advise its closing. The women are, in most cases, perfectly willing to be treated at the District Hospital, and as a fact are so treated in large numbers every year.

*Outdoor Department.*

*Dispensaries attached to Hospitals—*

| | New cases | Repetitions | Total visits |
|---|---|---|---|
| 1908 | 43,263 | 19,690 | 62,953 |
| 1909 | 42,390 | 20,349 | 62,739 |

*Travelling Dispensaries—*

| | New cases | Repetitions | Total visits |
|---|---|---|---|
| 1908 | 24,704 | 8,687 | 33,391 |
| 1909 | 25,675 | 10,599 | 36,274 |

It is satisfactory to note that the number of the labouring classes availing themselves of these dispensaries is increasing.

*Vaccination.*

The total number of vaccinations during the year was 11,367, being an increase of 660 over 1908. Out of these, 80·93 per cent. were perfect, a result above the average.

*Veterinary Branch.*

*Rinderpest.*—An outbreak of this disease occurred at Port Weld towards the end of February.

In the Quarantine Station at the time there were 146 animals, and of this number no less than 116 died.

**Colonial Medical Reports.—No. 4.—Federated Malay States—Perak—(*continued*).**

Twenty-one animals died before the anti-rinderpest serum was brought into use, and out of the 105 animals inoculated ninety-five died—a result such as this can only have been due to bad serum.

Another outbreak happened at Telok Anson in November, 335 animals being in the Quarantine Station at the time; of this number 149 contracted the complaint, out of which seventy-eight died, sixty-six were shot, one recovered, four remained under treatment on December 31.

The serum was inoculated in sixty-five cases, and of this number thirty-four subsequently developed the disease.

Mr. Short suggests that serum should be prepared in the Federated Malay States. It seems that some such measure is necessary, for on no less than two occasions lately, the Indian Civil Veterinary Department have been unable to execute our indents.

*Foot and mouth disease* of a mild type occurred in Larut and Matang, but no deaths were recorded.

*Swine fever* broke out at Ayer Kuning in June, causing the death of nine pigs; the disease, however, did not spread.

At Matang also in November six pigs died from this complaint; and at Pasir Itam a whole litter of pigs, imported from Bukit Mertajam, died—not, however, before they had infected eight other pigs in the same sty.

*Surra.*—In Krian seven ponies were affected with this complaint, out of which number two died and five were shot.

*Rabies.*—Two cases were discovered in Taiping. Fifteen dogs, known either to have been bitten or to have been in contact with these, were destroyed.

*Fowl cholera* occurred in Taiping in August. Bacteriologically it was identified with the European type.

Mr. Moir did some most interesting work on the differentiation of buffaloes' and cow's milk by means of anti-sera produced in rabbits. As he points out the differentiation is most important, seeing that no less than 50 per cent. of water can be added to buffaloes' milk without the fat percentage falling below the standard for cow's milk.

*Remarks on Particular Diseases.*

*Malaria.*—The total number of in-patients treated numbered 7,404, being slightly in excess of the previous year; the deaths, however, have fallen considerably, as shown below:—

| | Treated | | Deaths | | Percentage | |
|---|---|---|---|---|---|---|
| | 1908 | 1909 | 1908 | 1909 | 1908 | 1909 |
| Malarial fevers .. | 7,310 | 7,404 | 474 | 426 | 6·48 | 5·75 |

For some reason the number of cases have increased at Ipoh and Kampar, whereas at several other stations the opposite has been the case.

*Prophylaxis of Malaria.*—It would serve no useful purpose to serve up a *réchauffé* of Ross's valuable work on the subject, but it is perhaps as well to consider which of his methods is best suited to Perak.

For the larger towns there can be little doubt that anopheline reduction, by means of general sanitation and good surface drainage, has in the past, and is still justifying the financial outlay.

For rural districts such methods are out of the question, and we must look to other means. Much has been written on the pouring of kerosene on the surface of all collections of water in the neighbourhood of kampongs, &c.; the expense of this is, however, great, and most unfortunately lends itself to methods of peculation; one can imagine that much of the kerosene given out would go elsewhere than on the surface of the waters.

In passing one may notice the method of protecting the individual against the bites of mosquitoes by nets, &c. In the case of Malay children this is not practical, and may be put out of court.

Dr. Peart, in his report, refers to a most important procedure—namely, that suggested by Dr. Prout of cinchonizing all children with enlarged spleens. We are, as a matter of fact, about to send out quantities of quinine for distribution among the kampong Malays.

I suggest that the schoolmaster of each kampong should keep a register, and give quinine (in varying doses according to age) to each boy suffering from chronic kora. The quinine must be given twice daily, and continued for four months at least. I have myself verified the statement that gametes of all types of malaria may be found in the blood for some weeks, in spite of the patient taking 10 gr. of quinine three times daily.

It is the general opinion that the native has in the past known little of the beneficial effects of quinine, and even when they take advantage of the method, do not continue it after the fever is subdued.

It must be remembered that quinine is not only a method of treatment for the particular individual, but is also a means for protecting the sufferer's neighbours, since having taken the drug and driven the parasite from his blood thereby, he is not the possible source of infection to his fellow men that he was before.

So every man who takes quinine for his kora over a period of several months, will not only mean one man cured, but many others protected.

This method of thoroughly controlled quinine administration over prolonged periods will be, I think, our strongest line of defence in the rural districts.

*Beri-beri.*—During the year only 1,778 cases were treated as compared with 3,618 for the previous year. The mortality also has very considerably fallen, as will be seen from the subjoined table:—

| Year | Number of cases treated | Deaths | Percentage of deaths |
|---|---|---|---|
| 1908 .. .. | 3,618 | 838 | 23·16 |
| 1909 .. .. | 1,778 | 184 | 10·34 |

Inundated with perennial new theories on this subject it is a pleasure to report on the success which has crowned the labours of our Institute of Medical Research. In the last Brochure of Studies, Drs. Fraser and Stanton have set forth, in epitomized form, their most recent findings.

It has long been recognized that fowls fed on rice, known to have been associated with an outbreak of beri-beri, will develop a disease, which, whether or not

it be analogous to that complaint, can at any rate be taken as an indication as to the likelihood of such rice being capable of producing beri-beri in man. They point out that the reason for the occurrence of beri-beri on a diet in which white rice forms the staple, lies in the fact that such rice is deficient in substances which are essential for the normal maintenance of nerve nutrition.

In the fresh padi, parboiled rice, or that prepared by Malay methods, these substances are present in adequate amounts, and in the rice polishings (produced in the manufacture of white rice) they exist super-abundantly. They are, therefore, contained in the external layers of the grain, and white rice differs from the other varieties, in much the same way as white bread differs from Hovis.

These gentlemen show that there is no question whatever of a poison, or fungus, developing in the grain with age, for the white rice is just as potent for harm on the day it is milled as at any subsequent period. White rices also differ among themselves in regard to their harmful effects, the Rangoon being much less so than the Siamese.

There seems also no doubt that the other constituents of the diet may make up for what is lacking in the white rice. This would explain the rarity of the disease among the towkays, shop assistants, and Hylam house-boys, who supplement their white rice diet by many other foodstuffs; and the frequency in mining camps, agricultural coolie lines, asylums, hospitals, and gaols, where the staple is white rice, and little else.

An analysis of the various rices was made at the Institute and the phosphorus content (expressed as $P_2 O_5$) determined with the following result:—

| | |
|---|---|
| Parboiled rice not causing disease in fowls after many weeks feeding .. | ·469 per cent. |
| White rice causing the disease in fowls in a few weeks .. .. .. .. | ·277 ,, |
| Rice polishings .. .. .. .. | 4·2 ,, |

But most important of all it was found that feeding fowls on this same sample of white rice, plus rice polishings, did not cause the disease, all the fowls remaining healthy.

It is too soon to make suggestions, but there can be no doubt that the main line of prophylaxis will be inspection and regulation of dietaries. It seems that by such simple means beri-beri may be stamped out and another record added to the romance of scientific medicine.

*Leprosy.*—Dr. Graham, who is in charge of the leper colony at Pulau Pangkor Laut, suggests that the "nastin treatment" be given a fair trial.

Now shortly put, the nastin treatment amounts to this: Deycke Pasha, of Constantinople, found that benzoyl chloride deprived tubercle bacilli of their greasy coat. He drew the conclusion that it would do so also in the case of the lepra bacilli (which belong to the same group, but unlike tubercle cannot be cultivated).

Nastin itself is a fatty principle extracted from an organism which Deycke Pasha cultivated from a leper, not the leper bacillus itself. Now when this nastin was injected into lepers it was found to give a reaction similar to that of tuberculin in tuberculosis.

Deycke found that benzoyl chloride given by itself did not reach the leper bacilli, but was wasted and lost in other directions. It wanted to be guided to the bacilli, and that guidance was found in combining it with nastin.

Benzoyl-nastin is then the substance which is injected for the cure of leprosy.

Apparently the Colonial Government of British Guiana have appointed a special medical man to carry out this treatment, under the direction of Deycke Pasha himself, at the leper colony near Georgetown.

Some of the photographic results I have already seen of this treatment do not appear to be very convincing, and the theory itself is rather far-fetched. I think, therefore, that until full and favourable reports are received from British Guiana our best attitude is one of healthy scepticism.

*Ankylostomiasis.*—Ankylostoma, or hookworm infection, is widespread indeed, and in this connection I will quote Dr. Graham, of Telok Anson, who examined a large number of coolies on two estates in his district with the following results:—

| Name of estate | Number examined | Number in which ova were present | Percentage |
|---|---|---|---|
| Nova Scotia .. | 26 .. | 21 .. | 73·00 |
| Sungei Wangei .. | 250 .. | 172 .. | 68·80 |

The ankylostoma, while its numbers are small, does not give rise to much inconvenience, but when present in hundreds or thousands, they set up a grave cachexia which we call ankylostomiasis, leaving the patient helpless and bloodless, and often leading to a fatal result.

The number of deaths certified as being caused directly by this infection during the year was 817, but this gives no idea whatever of the number of deaths in which this terrible and insidious disease has been a factor.

Dr. Graham has recently published an article on this subject ("JOURNAL OF TROPICAL MEDICINE AND HYGIENE," November 15, 1909), and draws attention to the infection of animals with this parasite. He says "It was difficult to find an animal ankylostoma free."

| Animals examined | Ova present |
|---|---|
| 12 dogs .. .. .. .. | 12 |
| 3 goats .. .. .. .. | 3 |
| 3 buffaloes .. .. .. .. | 8 |
| 6 chickens .. .. .. .. | 6 |
| 2 chicks .. .. .. .. | — |
| 2 guinea pigs .. .. .. | — |
| 1 tiger cat .. .. .. .. | 1 |
| 3 cats.. .. .. .. .. | 3 |

Now if all these animals were infected with the human parasite the problem of prophylaxis would, I fear, be almost hopeless. I believe, however, I am correct in saying that although the eggs found by Dr. Graham may have appeared to be identical with those of the human variety, yet they probably were those of other species.

The common hookworms found in dogs here are the *Uncinaria trigonocephala* and the *U. stenocephala*, both of which, as far as I know, have never been found in man. From books also I learn that the hookworm found in the goat is the *U. cernua*, and that of cattle the *U. radiata*.

Rathonge, in 1896, thought he had found the eggs

of ankylostoma duodenale in the excrement of horses; he was, however, in error, for the ova and embryos, which he cultivated from them, turned out to be those of *Sclerostomum tetracanthum*, quite another genus of parasite.

A. E. Boycott and J. S. Haldane have recently issued a report on the progress of ankylostomiasis in the Cornwall mines, and have shown that the introduction of sanitary conveniences, both above and below ground, have enormously reduced the terrible cases of breathlessness and pallor that were met with in the mines previously, but at the same time it had had little effect in diminishing the number of individuals in whose excrement ova could be demonstrated.

This shows how much may be done by managers of estates by preventing the indiscriminate casting about of night-soil, and insisting on the systematic use of trenches, or some such simple contrivance. It is well known, of course, that after its second moulting the ankylostoma can live in muddy water for weeks, or perhaps months, moving sluggishly about, and in this way the coolies become infected, mostly by its boring its way through the skin of the feet, but sometimes, possibly, by the men actually swallowing them direct.

Manifestly then the problem is summed up in cleanly habits.

*Phthisis.*—Dr. Clarke writes at some length on this subject, pointing out the rarity in this country of tuberculosis in pigs, and its complete absence in cattle. He says "The problem is narrowed down to human tubercle," and goes on to advise notification for the better classes and compulsory isolation for the coolie classes.

For my own part I believe the above methods are somewhat drastic. The phthisis problem resolves itself, in this country, into housing reform, but it is desirable that the more crowded quarters of the towns should be visited from time to time, and where bed-ridden phthisis cases are found shut up in airless and ill-ventilated rooms, every effort should be made to persuade the friends to bring the sufferers to hospital in order to avoid them further infecting the other inhabitants of the house.

*Infectious Diseases.*—Happily during the year there have been no cases of small-pox or cholera, and among other infectious complaints I have only to record twenty-four cases of chicken-pox and one case of measles.

*Meteorology.*

The highest temperature recorded in the shade was at Batu Gajah and Grit, 96° F. The minimum was at Gopeng, 61° F.

The highest rainfall was at Taiping, 181·50 in., the figure for the previous year being 182·48.

*General.*

*Microscopical Examinations.*—At all the larger hospitals numerous examinations have been made, in some cases amounting to many thousands. I need not point out that this means much greater accuracy of diagnosis than was possible in former times.

*Diets.*—On the Resident's instructions parboiled rice was substituted for Rangoon white rice in all the hospitals of Perak in February (with a few exceptions, such as the Malay Hospital at Kuala Kangsar and the Malay Leper Settlement at Pulau Pangkor Laut).

On the recommendation of a special committee, appointed by the Resident-General, new diet scales were drawn up, and brought into use in November, for six months' trial.

## Colonial Medical Reports.—No. 4.—Federated Malay States.

### State of Selangor.

# MEDICAL REPORT FOR THE YEAR 1909.

**By G. D. FREER.**

*Senior Medical Officer, Selangor.*

SPEAKING generally there has been a marked improvement in the health of the State during the year 1909. The total number of deaths registered shows a reduction of nearly 25 per cent. compared with 1908, and the total admissions to Government hospitals an almost identical reduction with a lessened case-mortality. In comparing the figures for the two years, it must, however, be borne in mind that the year 1908 was an exceptionally unhealthy one.

VITAL STATISTICS.

The following table shows the total births and deaths registered during the last five years with the approximate birth- and death-rates:—

| Year | Estimated population | Births | Birth-rate per mille | Deaths | Death-rate per mille |
|---|---|---|---|---|---|
| 1905 .. | 252,502 .. | 2,857 .. | 11·31 .. | 6,756 .. | 26·75 |
| 1906 .. | 283,619 .. | 2,820 .. | 9·94 .. | 8,303 .. | 29·27 |
| 1907 .. | 326,642 .. | 3,188 .. | 9·75 .. | 10,177 .. | 31·15 |
| 1908 .. | 341,180 .. | 3,564 .. | 10·44 .. | 12,327 .. | 36·13 |
| 1909 .. | 354,982 .. | 3,981 .. | 11·21 .. | 9,306 .. | 26·21 |

The estimated population at the end of the year was 354,982, calculated as in previous years on the method laid down in the Model Medical Report. The next census will probably show the population to have been considerably over-estimated. Compared with 1908 there was an increase in the total number of births registered of 417. All the districts showed an increase except Ulu Selangor. The greatest increase was in the Klang district, and among Indians.

Three thousand and twenty-one fewer deaths were registered than in 1908. The reduction was marked in all districts except Kuala Langat, and among all nationalities except Eurasians.

The largest number of deaths was registered in the fourth quarter of the year.

### Meteorological Conditions.

*Temperature.*—The mean temperature for the year varied only slightly in different districts, Ulu Langat showing the lowest, 80·1° F., and Kuala Selangor the highest, 82° F.

At Kuala Lumpur, the mean temperature for the year was 80·4° F., the mean maximum 89° F., and the mean minimum 71·9° F. The highest temperature recorded was 94° F. on July 8, and the lowest, 66° F., on July 19.

*Rainfall.*—Observations were recorded at twelve stations and showed considerable variations. The total rainfall for the year was highest at Kuala Kubu, where 132·51 in. were recorded, next coming Rawang 112·45 in., Kajang 95·82 in., Serendah 95·81 in. At the General Hospital, Kuala Lumpur, and Klang, 84·35 in. and 84·10 in., respectively, were recorded. At Kuala Lumpur the mean annual rainfall for the last thirty-one years works out to 95·37 in., so that there the rainfall for 1909 was more than 10 in. below the average. At Kuala Kubu, on the contrary, the rainfall was well above the average. The monthly rainfall also showed considerable variations in different districts. March being the wettest month at Kuala Lumpur, Kajang and Rawang; February at Klang and Kuala Selangor; August at Kuala Kubu and Serendah; and November at Kuala Langat.

There was a falling off in the total number of patients treated in the State Hospitals for the year, which was partly due to its having been a more healthy one, partly also to many of the estates now being provided with their own hospitals.

All the hospitals showed a decrease in the number of patients treated except the European Hospital, Kuala Lumpur, and the small district hospital at Sungei Besi. At the Klang, Kuala Lumpur, and Ulu Selangor district hospitals the decrease was most marked. The percentage of deaths to total treated was 10·81 compared with 14·15 in 1908.

The nationalities of the patients treated was as follows: Europeans, 191; Eurasians, 122; Chinese, 11,177; Tamils, 8,642; Malays, 900; other Nationalities, 1,857.

### Special Diseases.

No cases of cholera or plague were reported during the year. There were three admissions for small-pox, and a few cases of chicken-pox, measles, dengue, and mumps also came under notice. Twenty-five patients with enteric fever were admitted as against twenty-eight in 1908.

### Prevailing Diseases.

The following table shows the diseases more commonly treated with percentage of deaths:—

| | Cases | Deaths | Percentage of deaths |
|---|---|---|---|
| Malarial fever | 5,522 | 322 | 5·83 |
| Beri-beri | 2,055 | 398 | 19·36 |
| Skin diseases | 3,107 | 16 | 0·51 |
| Dysentery | 1,041 | 381 | 36·59 |
| Diarrhœa | 714 | 121 | 16·94 |
| Venereal diseases | 865 | 22 | 2·54 |
| Pulmonary ,, | 1,156 | 398 | 34·42 |
| Injuries | 1,169 | 42 | 3·59 |
| Ankylostomiasis | 579 | 64 | 11·05 |
| Rheumatism | 679 | 3 | 0·44 |
| Anæmia | 474 | 85 | 17·72 |

*Malaria.*—This disease was, as usual, by far the most important cause of sickness. The satisfactory decrease in the mortality from it, and in the total cases treated in the various hospitals as shown in the table below, coincides with the very great reduction in the general mortality from all causes mentioned under vital statistics:—

| Year | Cases treated | Deaths | Mortality |
|---|---|---|---|
| 1904 | 2,008 | 114 | 5·67 |
| 1905 | 2,109 | 173 | 8·20 |
| 1906 | 3,397 | 348 | 10·24 |
| 1907 | 8,084 | 685 | 8·47 |
| 1908 | 6,489 | 525 | 8·09 |
| 1909 | 5,522 | 322 | 5·83 |

At all the hospitals, except the European and the small district hospitals at Kuala Langat and Kajang, there was a marked reduction in the number of admissions for malaria. In the Kajang district a large amount of land is being opened up for rubber planting, and at present it is not so well supplied with estate hospitals as the Klang district.

As to the type of the disease, in 2,924 cases at the native hospitals in which a reliable microscopical identification of the parasite was made, the subtertian parasite was found in 67·3 per cent., while at the European Hospital it was only found in twenty out of fifty-eight cases examined, or 34·4 per cent.; the remaining thirty-eight cases all showing benign tertian parasites. The benign tertian parasite alone was found in 686 cases at the native hospitals, and the benign quartan in 265 cases. Of mixed infections, the subtertian and benign tertian forms were found in eighty-two cases, and benign tertian and quartan in three.

The reason why the subtertian form should be so much less common among Europeans has never yet been satisfactorily explained. It appears, however, to be a general rule. It is satisfactory to record that no deaths from malaria occurred at the European Hospital. Half ounce doses of Warburg's tincture three times daily was the favourite treatment there in severe cases as long as the fever lasted.

The total amount of malaria in Kuala Lumpur is less than in the previous year, but the incidence of the disease in certain parts of the town continues to cause much uneasiness.

This has been more particularly the case in the European residential quarter, and especially in those areas reported on by a Commission appointed at the end of 1907 to investigate the growing prevalence of malaria among Europeans in Kuala Lumpur.

**Colonial Medical Reports.—No. 4.—Federated Malay States—State of Selangor—(*continued*).**

Reference was made to this Commission in my Annual Report for 1908, and to the inefficiency of the open rubble drains put down for dealing with the drainage of the numerous small gullies and valleys intersecting the hilly ground on which most of the European houses are situated. During the last three or four months of the year under review the outbreak of malaria assumed alarming proportions, especially among those occupying quarters situated in the General Hospital, Federal Hill, and Club Road areas, and few escaped an attack of fever. Further representations have been made on the subject, and it is hoped that more effective methods of drainage will shortly be undertaken.

Three cases of blackwater fever came under my notice during the year: all European planters from estates. Two were admitted to the European Hospital with a history of having lived in the East about two years, and having had a good deal of ordinary malaria for which they had dosed themselves freely with quinine. Both were mild cases and easily amenable to treatment. The third case, treated outside, was very severe in type and rapidly proved fatal.

To gain some idea of the amount of malaria in various parts of the Coast district, Dr. Gerrard made two spleen censuses of the children in the different schools. In April 2,001 children were examined and 203 found to have enlarged spleens, a percentage of 15·84. In August, of 1,146 children examined 143 had big spleens, a percentage of 12·48. He attributes the diminution at certain places in the August census partly to the effect of quinine distribution. Most of the schools were examined, and they afford a useful indication of the places where malaria is most prevalent. As was to be expected, Batu Tiga easily heads the list, while among the least malarious places appear to be Klang, Kapar, Telok, Bandar, and Telok Gadong. He draws special attention to Kuala Selangor, as not being so free from fever as has hitherto been imagined.

At Port Swettenham another spleen census of all the school children under 10 years of age was carried out in December by Dr. Millard, with the result that only 8·2 per cent. were found with enlarged spleens, and within the bunded area only 6·9 per cent.

A large amount of money was spent at Port Swettenham on anti-malarial measures during the year. The Railway and Public Works Departments alone spent over $20,000 on drainage and filling in of swamps. Out of Sanitary Board votes between $2,000 and $3,000 was spent in upkeep of drains, Government grounds, and on scavenging. In addition, there was some minor expenditure in free distribution of quinine and kerosening undrained or undrainable ponds. Towards the end of October considerable damage was done to the present bunds by unusually high tides which are reported to have been about 2 ft. higher than anything previously recorded. The damage done has since been rectified, and a scheme is now being put forward for increasing the bunded area.

At Klang $4,674 were spent in drainage and filling in of swamps, and the town itself is said to be almost free from malaria. Nearly $5,000 were spent on the Bukit Rajah anti-malarial scheme. It consisted chiefly in deepening and regrading about 2 miles of the main drain along the Sungei Binjai Road, one of the main roads leading out of Klang, and in improving the subsidiary drainage.

*Beri-beri.*—There were 2,055 patients admitted to the State hospitals suffering from this disease, 393 of whom died, the percentage being 19·36.

Although the total number of patients treated during 1909 is 1,407 fewer, and the mortality slightly less than in the previous year, there is no marked improvement when the figures of a series of years are examined.

The explanation is that nearly all the beri-beri patients are Chinese, who also form about half the admission from all causes to the hospitals.

Until this section of the community can be induced to give up the use of Siam rice, beri-beri will continue to form one of the chief prevailing diseases.

The estates in Selangor employing Tamil labour use parboiled rice, and are practically free from beri-beri.

One Chinese-owned estate, employing Chinese labourers, fed on Siam rice, had several beri-beri patients in the estate hospital when visited by me.

The diminution in the number treated and in the mortality from beri-beri was well marked at nearly all the hospitals.

No cases occurred at all in the asylum, where parboiled rice has been supplied to the inmates since July, 1908. The only case in the gaol was a Chinaman, who was admitted to the prison suffering from the disease in an acute form, and who died a few hours after admission. As in the previous year there was not a single case of beri-beri contracted in the gaol throughout the year, and the use of Rangoon (uncured) rice in the prison diet was continued.

At the District Hospital, Kuala Lumpur, Rangoon rice was used throughout the year for all Chinese patients.

At the other hospitals parboiled rice was mostly used in the diets of beri-beri patients.

As bearing on the connection between rice and beriberi it is worth recording that in April an outbreak of beri-beri commenced among about a hundred Malays recently enlisted into the Police Force, and stationed in barracks at the Police Depôt, Kuala Lumpur. From the reports made by Dr. Gimlette, who was then in charge at the General Hospital, and to whom I am indebted for a careful clinical examination and notes on each case, it appears that on April 24, nineteen men, all Malays except one Javanese, were found to be suffering with symptoms of the disease in an early stage. The rice they had been using was found to be No. 2 Siam, and it appeared that for some months cases of beri-beri had occurred from time to time among the Malays at the Depôt. Acting on my suggestion, parboiled rice was at once substituted for Siamese in their diets.

Five more cases occurred in April, and one in May making a total of twenty-five cases, all of whom eventually recovered. The May case turned out to have been a married man living, not in the barracks, but in the married quarters with his wife and family,

and who had continued to eat Siamese rice, although advised not to do so. By June the health of the Malays at the Depôt had much improved, and the occurrence of any further cases of the disease ceased. The Siam rice used by the Malays at the time of this outbreak was among the rices employed by Drs. Fraser and Stanton at the Institute in their feeding experiments on fowls. All their researches on the etiology of beri-beri so far appear to amply confirm the truth of Dr. Braddon's contention that beri-beri out here is connected with the consumption of certain forms of rice, and may be prevented by the use of parboiled rice.

Their recent work also appears to explain why certain rices produce beri-beri and others do not, and incidentally why the prisoners in the gaol fed on Rangoon (an uncured) rice have been comparatively free from the disease for several years.

*Dysentery and Diarrhœa.*—The hospital statistics showed a great reduction in the number of cases treated with a lessened mortality in these two diseases, which, as usual, come next to malaria and beriberi as the most important causes of sickness and death. At the District Hospital, Kuala Lumpur, Dr. McClosky reports that out of 401 admissions for dysentery the excreta was examined in all cases for amœbæ, and in only fourteen cases were they found. This is contrary to the experience at the Tan Tock Seng Hospital in Singapore, where the large majority of the cases are said to be of amœbic origin. In fifteen cases in which he found amœbæ, anti-dysenteric serum was used, and out of these six died. The difficulty he experiences in testing the serum treatment is to find sufficiently early and suitable cases.

*Ankylostomiasis.*—The admissions into all the Government hospitals for this disease were only 490 as compared with 833 in 1908, and the percentage of deaths to total treated 11·05 as against 29·29 per cent. At Klang hospital, where the admissions fell from 1,414 in 1908 to 176 in 1909, and the mortality from 37·34 to 20·4 per cent., Dr. Millard attributes the diminution partly to fewer estate coolies coming for treatment owing to the establishment of estate hospitals.

Another reason may be the greater care taken by Medical Officers before returning a patient as suffering from ankylostomiasis merely because a few ova happen to be found in the stools. For instance, in reporting on the District Hospital, Kuala Lumpur, Dr. McClosky writes :—

"The ova of ankylostoma were found in 415 patients, but only 60 were returned." At Kuala Kubu Hospital Dr. Harrison examined the fæces of 1,441 patients, out of a total of 1,657 treated in the hospital, and found the ova of ankylostoma present in 45·38 per cent. In 195 cases only was the disease returned as ankylostomiasis.

In his report on the disease, he says: "It will be seen that the Malays, including the Javanese, as in my former report, head the list as regards infection with ankylostoma, and of 129 cases examined 92 were infected, or a case-percentage of 71·31 as compared with 57·69 in 1908. The Tamils come next with a percentage of 51·05 as compared with 52·41. Other Indians follow with a percentage of 39·34 as compared with 32; Chinese show a percentage of 36 as compared with 38·05."

In a series of examinations made by Dr. Stanton among Tamil coolies employed on estates the proportion of infected persons varied from 25 per cent. on a healthy estate to 56 per cent. in the case of patients admitted to an estate hospital.

That a large proportion of the population harbour the parasites without themselves suffering from the effects has been known here for years. The modern view is to regard such people as carriers of the disease, who although immune themselves, are none the less a danger to others, especially to those whose resisting powers happen to be lowered by malaria or other causes. The chief preventive measures recommended are general sanitary ones which have to do with water supply and the prevention of fæcal contamination of the soil. Within the Sanitary Board limits of the towns and larger villages powers already exist for enforcing such.

*Pulmonary Diseases.*—There was a slight reduction in the total treated, while the percentage of deaths remained about the same. The number of admissions for phthisis was 386, and for pneumonia 263, as against 404 and 303, respectively, in 1908. Most of the phthisis cases were, as usual, centralized at the District Hospital, Kuala Lumpur, where there is a special ward set apart.

*Vaccination.*—The total number of persons vaccinated was 10,522. As usual, more than half were Tamils, and most of them coolies for various estates who were dealt with on arrival at Port Swettenham, and about whom no information was obtainable afterwards as to the success of the operation. Of 5,868 persons who were seen afterwards, the vaccination was perfect in 4,965, or over 8·4 per cent. modified in 611, and in 292 it failed.

Saigon lymph has been used here for many years and so far no other lymph has been found to equal it. In September, Dr. Wellington, the Health Officer, tried three varieties of lymph sent from England on sixty-three people, of whom only two gave a positive result. Of thirty-nine children who failed, thirty-five were re-vaccinated with fresh Saigon lymph, with the result that thirty-one reacted satisfactorily. The vaccinations were performed at intervals of four to nineteen days after the receipt of the lymph from home, and he concludes that by the time it reaches here, glycerinated lymph has no merit whatever, and the dried variety very little. The lanolinated was inert eighteen days after arrival.

The number of out-door patients treated during the present year shows a considerable decrease, but not so marked as in the case of the in-patients.

### Details of Individual Hospitals.

*European Hospital, Kuala Lumpur.*—Number of in-patients, 170; number of deaths, 2; percentage of deaths, 1·17; average daily number of sick, 7·08.

The two deaths were due to tetanus following a compound fracture of the fore-arm, and suppurative appendicitis with a gangrenous appendix.

Fever accounted for seventy-three of the cases treated.

Three cases of abscess of liver were operated on

## Return of Diseases and Deaths in 1909 at all the Hospitals in Selangor.

### GENERAL DISEASES.

| | Admissions | Deaths | Total Cases Treated |
|---|---|---|---|
| Alcoholism | 12 | — | 12 |
| Anæmia | 443 | 85 | 474 |
| Anthrax | — | — | — |
| Beri-beri | 1706 | 398 | 2055 |
| Bilharziosis | — | — | — |
| Blackwater Fever | 3 | 1 | 3 |
| Chicken-pox | 4 | — | 4 |
| Cholera | — | — | — |
| Choleraic Diarrhœa | 1 | 1 | 1 |
| Congenital Malformation | — | — | — |
| Debility | 189 | 76 | 199 |
| Delirium Tremens | 3 | — | 3 |
| Dengue | 4 | — | 4 |
| Diabetes Mellitus | 1 | — | 1 |
| Diabetes Insipidus | 10 | 1 | 10 |
| Diphtheria | — | — | — |
| Dysentery | 983 | 381 | 1041 |
| Enteric Fever | 25 | 11 | 28 |
| Erysipelas | 20 | 2 | 20 |
| Febricula | — | — | — |
| Filariasis | — | — | — |
| Gonorrhœa | 251 | — | 258 |
| Gout | — | — | — |
| Hydrophobia | — | — | — |
| Influenza | — | — | — |
| Kala-azar | — | — | — |
| Leprosy | 303 | 45 | 499 |
| (*a*) Nodular | — | — | — |
| (*b*) Anæsthetic | — | — | — |
| (*c*) Mixed | — | — | — |
| Malarial Fever— | — | — | — |
| (*a*) Intermittent | — | — | — |
| Quotidian | — | — | — |
| Tertian | 2584 | 189 | 2781 |
| Quartan | 237 | — | 243 |
| Irregular | 6 | 2 | 6 |
| Type undiagnosed | 2387 | 79 | 2441 |
| (*b*) Remittent | — | — | — |
| (*c*) Pernicious | — | — | — |
| (*d*) Malarial Cachexia | 142 | 51 | 148 |
| Malta Fever | — | — | — |
| Measles | 3 | — | 3 |
| Mumps | 11 | — | 11 |
| New Growths— | — | — | — |
| Non-malignant | 23 | 2 | 24 |
| Malignant | 33 | 16 | 34 |
| Old Age | — | — | — |
| Other Diseases | 22 | 14 | 24 |
| Pellagra | — | — | — |
| Plague | — | — | — |
| Pyæmia | 1 | — | 1 |
| Rachitis | — | — | — |
| Rheumatic Fever | — | — | — |
| Rheumatism | 657 | 3 | 679 |
| Rheumatoid Arthritis | — | — | — |
| Scarlet Fever | — | — | — |
| Scurvy | — | — | — |
| Septicæmia | 3 | 3 | 3 |
| Sleeping Sickness | — | — | — |
| Sloughing Phagedæna | 41 | 15 | 41 |
| Small-pox | 3 | — | 7 |
| Syphilis | — | — | — |
| (*a*) Primary | 220 | — | 229 |
| (*b*) Secondary | 141 | 1 | 155 |
| (*c*) Tertiary | 195 | 21 | 195 |
| (*d*) Congenital | 15 | — | 28 |
| Tetanus | 3 | 3 | 3 |
| Trypanosoma Fever | — | — | — |
| Tubercle— | 10 | — | 14 |
| (*a*) Phthisis Pulmonalis | — | — | — |
| (*b*) Tuberculosis of Glands | — | — | — |
| (*c*) Lupus | — | — | — |
| (*d*) Tabes Mesenterica | — | — | — |
| General Diseases—*continued.* | | | |
| (*e*) Tuberculous Disease of Bones | — | — | — |
| Other Tubercular Diseases | — | — | — |
| Varicella | — | — | — |
| Whooping Cough | — | — | — |
| Yaws | — | — | — |
| Yellow Fever | — | — | — |

### LOCAL DISEASES.

| | Admissions | Deaths | Total Cases Treated |
|---|---|---|---|
| Diseases of the— | | | |
| Cellular Tissue | 371 | 17 | 424 |
| Circulatory System— | — | — | — |
| (*a*) Valvular Disease of Heart | 63 | 31 | 68 |
| (*b*) Other Diseases | 26 | 16 | 30 |
| Digestive System— | — | — | — |
| (*a*) Diarrhœa | 694 | 121 | 714 |
| (*b*) Hill Diarrhœa | — | — | — |
| (*c*) Hepatitis | 22 | 2 | 23 |
| Congestion of Liver | 2 | — | 2 |
| (*d*) Abscess of Liver | 15 | 2 | 15 |
| (*e*) Tropical Liver | — | — | — |
| (*f*) Jaundice, Catarrhal | 19 | 6 | 20 |
| (*g*) Cirrhosis of Liver | 130 | 71 | 138 |
| (*h*) Acute Yellow Atrophy | — | — | — |
| (*i*) Sprue | 15 | 11 | 15 |
| (*j*) Other Diseases | 504 | 42 | 512 |
| Ear | 45 | 4 | 45 |
| Eye | 237 | 9 | 279 |
| Generative System— | — | — | — |
| Male Organs | 390 | 2 | 438 |
| Female Organs | 88 | 6 | 104 |
| Lymphatic System | 505 | 4 | 551 |
| Mental Diseases | — | — | — |
| Nervous System | 482 | 82 | 609 |
| Nose | 8 | — | 8 |
| Organs of Locomotion | 115 | 15 | 119 |
| Respiratory System | 1103 | 398 | 1156 |
| Skin— | — | — | — |
| (*a*) Scabies | — | — | — |
| (*b*) Ringworm | — | — | — |
| (*c*) Tinea Imbricata | — | — | — |
| (*d*) Favus | — | — | — |
| (*e*) Eczema | 98 | — | 101 |
| (*f*) Other Diseases | 2799 | 16 | 3006 |
| Urinary System | 339 | 105 | 367 |
| Injuries, General, Local— | 1097 | 42 | 1165 |
| (*a*) Siriasis (Heatstroke) | — | — | — |
| (*b*) Sunstroke (Heat Prostration) | — | — | — |
| (*c*) Other Injuries | — | — | — |
| Parasites— | 453 | 3 | 499 |
| Ascaris lumbricoides | 156 | — | 160 |
| Oxyuris vermicularis | — | — | — |
| Dochmius duodenalis, or Ankylostoma duodenale | 490 | 64 | 579 |
| Filaria medinensis (Guinea-worm) | — | — | — |
| Tapeworm | — | — | — |
| Poisons— | — | — | — |
| Snake-bites | — | — | — |
| Corrosive Acids | — | — | — |
| Metallic Poisons | 5 | 2 | 5 |
| Vegetable Alkaloids | 3 | 1 | 5 |
| Nature Unknown | — | — | — |
| Other Poisons | 75 | 3 | 79 |
| *Surgical Operations*— | — | — | — |
| Amputations, Major | — | — | — |
| ,, Minor | — | — | — |
| Other Operations | — | — | — |
| Eye | — | — | — |
| (*a*) Cataract | — | — | — |
| (*b*) Iridectomy | — | — | — |
| (*c*) Other Eye Operations | — | — | — |

without a death. One case was of special interest. The patient, a planter, had lived in the east for twenty-three years. Five years ago he had dysentery, and since then he has been operated upon for liver abscess in this hospital on three occasions, in December, 1906, 1907 and 1909 respectively. He has again resumed his ordinary work on the estate.

Five cases of appendicitis were operated upon. One, as mentioned above, proved fatal.

*General Hospital, Kuala Lumpur.*—Number of in-patients, 3,788; number of deaths, 212; percentage of deaths, 5·59; average daily number of sick males, 112·90, females, 51·09.

The wooden floor of the old surgical ward was removed, and a concrete floor substituted. Some minor improvements were also effected. A new police ward was completed, and constables will now be treated here instead of in the police ward at the depôt.

*Police Ward, Police Depôt.*—Number of in-patients, 580; number of deaths, 6; percentage of deaths, 1·03; average daily number of sick, 19·19.

The six deaths were due to enteric fever 2, beri-beri 1, pericarditis 1, pneumonia 1, and peritonitis 1.

Two hundred and forty-eight cases of malarial fever were treated as compared with 336 in 1908. There were no deaths from this disease.

*Lunatic Asylum, Kuala Lumpur.*—Total treated, 230; number of deaths, 37; percentage of deaths, 16·08; average daily number, 84·61.

The nationalities of those under treatment comprised Chinese 157, Tamils 42, Malays 12, Javanese 9, Bengalis 4, Japanese 3, European, Cingalese, and Boyanese each 1.

*Gaol Hospital.*—Total treated in the hospital, 1,244; number of deaths, 4; percentage of deaths, ·32; average daily number of sick, 37·58.

The percentage of deaths to total treated was smaller even than that of the previous year, and the lowest so far recorded.

The four deaths were due to dysentery 2, pneumonia 1, beri-beri 1.

The principal diseases were: malarial fever 232 cases, dysentery 46 cases, wounds and ulcers 218, diseases of the digestive system 122.

The great bulk of the wounds were self-inflicted and wilfully aggravated to gain admission into hospital and thus avoid hard labour.

Of the dysentery cases the majority came to prison with the disease, but in the beginning of December twelve prisoners appeared to have contracted it in the gaol. The prompt action of the prison authorities quickly arrested any outbreak. The chief measures taken were isolation of all dysentery cases in the extra-mural ward, disinfection of cells, clothing, plates and cups which had been used by the sick, and the careful carrying out of the rule that all prisoners should be provided with weak tea to drink, and not with unboiled water.

*District Hospital, Kuala Lumpur.* — Total in-patients treated, 6,776; total deaths, 1,062; percentage of deaths, 15·67; average daily number of sick, 566·41.

Malarial fever accounted for 1,146 admissions; next in order coming beri-beri 915, ulcers 815, dysentery and diarrhœa 568.

The nationalities of the in-patients were: Chinese 4,544, Tamils 1,937, Bengalis 144, Malays 131, Singalese 15, Eurasians 4, Javanese 1.

One hundred and twenty-five estate coolies were admitted during the year, of whom 21 died, the deaths being due to dysentery 10, malaria 7, ankylostomiasis 1, pneumonia 1, Brights disease 1, myelitis 1.

A large amount of operative surgery was done at this hospital, including 35 major operations.

One hundred and twenty-eight patients were admitted from the Tung Shin Hospital, a private hospital managed by Chinese. Many of them were in a hopeless condition and 44 died. Sixty-eight of the patients were suffering from beri-beri.

*Leper Hospital.* — The admissions numbered 93, total treated 289, and percentage of deaths 15·22 per cent. as against 130, 298, and 16·44 per cent., respectively, in 1908. The average daily number was 209·24 as against 180·08. Owing chiefly to the employment of two extra watchmen only 22 absconded as against 42 in the previous year.

*Vagrant Ward.*—Two hundred and sixteen Chinese and 48 Tamils were admitted during the year. Of a total of 315 under treatment, 238 were discharged, 4 transferred, 4 absconded, 17 died, and 52 remained at the end of the year. Seven of the deaths were due to beri-beri.

*Klang Hospital.*—Total in-patients treated, 3,035; total deaths, 303; percentage of deaths, 9·98; average daily number of sick, 160·05.

Malarial fever accounted for 766 of the total treated; next in order coming fever (type not diagnosed) 259, ankylostomiasis 196, dysentery 121, beri-beri 111, diarrhœa 59.

*Kuala Selangor Hospital.*—Total in-patients treated, 504; total deaths, 37; percentage of deaths, 7·34; average daily number of sick, 36.

*Jugra Hospital.*—Total in-patients treated, 615; total deaths treated, 23; percentage of deaths, 3·73; average daily number of sick, 26·81.

A new ward was completed at this hospital. In order to try and induce Malays to come into hospital more freely, it was for the first two or three months set apart entirely for their use and the fact made known in the district. As only one or two availed themselves of the opportunity the ward was afterwards used to relieve the Kuala Selangor Hospital, which was overcrowded owing to the Jeram beri-beri patients having been transferred there.

*Kuala Kubu Hospital.*—Total in-patients treated, 1,657; total deaths, 253; percentage of deaths, 15·26; average daily number of sick, 99·25.

*Serendah Hospital.*—Total in-patients treated, 904; total deaths, 132; percentage of deaths, 14·60; average daily number of sick, 71·14.

*Rawang Hospital.*— Total in-patients treated, 1,088; total deaths, 63; percentage of deaths, 5·79; average daily number of sick, 67·89.

The above three hospitals, situated in the Ulu Selangor district, all show a decrease in the number of patients treated, and also a decrease in the percentage of deaths. Malarial fever, beri-beri, dysentery, ankylostomiasis, diarrhœa, and dysentery were the chief causes of admission in the order named.

**Colonial Medical Reports.—No. 4.—Federated Malay States—State of Selangor**—(*continued*).

*Kajang District Hospital.*—Total number of in-patients, 1,555; total deaths, 207; percentage of deaths, 13·31; average daily number of sick, 91·74.

A separate female ward was completed in August. Up to the end of the year 24 females were admitted, all Tamils except one Chinese and one Malay.

*Sungei Besi District Hospital.*—Total number of in-patients, 477; total deaths, 62; percentage of deaths, 13·01; average daily number of sick, 25·94.

The closing of some of the mines in this district probably accounts for the increase in the number of patients seeking admission. Of the total patients treated 451 were Chinese.

VETERINARY.

Mr. T. A. Ford, Veterinary Surgeon, reports:—

*Rinderpest.*—There were seven outbreaks during the year: three at Port Swettenham Quarantine Station, two at Klang, and one at Port Swettenham town. In four the infection was directly traced to cattle brought from Penang, in one the infection was probably due to infection on board the ship bringing the cattle from India, and in two the source could not be traced. Seventy-nine cases occurred with a total of 59 deaths. Of 159 animals inoculated with anti-rinderpest serum 17 died.

*Foot-and-Mouth Disease.*—There were 1,453 cases with 11 deaths. The first cases were two bullocks imported in January from Penang and who developed the disease at the Quarantine Station, Port Swettenham. In February the disease broke out in Klang, and from there spread to other districts in the State.

Eight sporadic cases of septicæmia hæmorrhagica occurred in January and February among bullocks belonging to Chinese and Tamils in Kuala Lumpur. All died within a few hours of being taken ill.

No cases of rabies, glanders, anthrax, surra, or swine fever were reported. A few cases of distemper in the dog were seen.

The Quarantine Station at Port Swettenham was extensively used during the year; altogether, 1,958 cattle and 885 buffaloes being quarantined there. Thirty-nine of the bullocks and 24 of the buffaloes died, mostly from rinderpest and enteritis. At Bukit Sintul Station 278 bullocks and 393 buffaloes were quarantined, 10 of whom died, 5 from rinderpest.

The Kuala Kubu Station was used for isolating foot-and-mouth disease cases and contacts during the outbreak in Ulu Selangor from June to October.

During the year 422 prosecutions were instituted for cruelty to animals and breaches of quarantine regulations, 374 convictions being obtained, and fines amounting to $4,883 imposed.

Other duties carried out by this department have been in connection with slaughter-houses, visiting and treating Government-owned cattle, inquiries into deaths of animals, visits to station pounds and out-stations.

## Colonial Medical Reports.—No. 4.—Federated Malay States.

### State of Pahang.

# MEDICAL REPORT FOR THE YEAR 1909.

**By S. C. G. FOX,**

*Medical Officer, Pahang.*

THE population in 1907 was estimated at 100,000, and in the absence of accurate returns of immigration and emigration it would be difficult to say with certainty if there has been any increase or decrease of the population, but with the incoming during the year of some 1,500 coolies engaged in railway construction and in rubber planting, it may fairly be assumed that the population of Pahang at the end of January, 1909, was more than 100,000. At the last census (1901) the population was found to be 84,113.

The Medical Officer in Charge, Pahang, is the Registrar of Births and Deaths for the whole State.

The returns are sent to him from the different District Officers, who are Deputy Registrars, except at Pekan, where the Medical Officer is Deputy Registrar.

The various Penghulus and police officers send their returns to the various Deputy Registrars. This arrangement has been found to work satisfactorily, and although there are often delays in the registration of deaths and births, the peasant is becoming more and more accustomed to the necessity of reporting a death or birth and the long delays of the past are becoming fewer.

The number of deaths registered during 1909 amounted to 3,012, as against 2,810 in 1908.

Calculated on a population of 100,000 the death-rate for 1909 works out at 30.10 per *mille*.

The number of births in 1909 was 2,300; in 1908 the figures were 2,448.

The mortality among infants under one year of age was 389, or 16.91 per cent. of total number of births.

It is significant that in the purely Malay districts of Temerloh and Pekan the deaths of children under twelve months of age were highest, and reached 89 and 116, respectively, out of a total number of births of 611 and 543 for each of these districts.

The chief causes of death among the infants, as reported by the parents, were fever, colic, and convulsions.

A large number of women lose their lives at childbirth, nor is this to be wondered at seeing that it is usually the oldest and dirtiest woman in the village who is the midwife.

*Zymotic Diseases and Vaccination.*—The vaccination is mostly performed by three vaccinators, who travel to the remotest parts of Pahang, and much of their success depends on the activity of the Penghulus (or headmen) in gathering together the children. From what I have noticed I feel sure that more could be done, but while transport is such a costly affair, the work of the vaccinators cannot be supervised as it should be. I have just issued a circular instructing the vaccinators not to be dependent on the Penghulus, but to themselves make, when possible, a house-to-house inspection; by this means they would treat children who now get overlooked. Each vaccinator is also instructed to take with him when visiting villages far from the beaten track tabloids of quinine (2 gr.) for the children suffering from fever. In 1907 there were 5,849 vaccinations, with failures 18.17 per cent.; in 1908 there were 4,052 vaccinations, with failures 11.03 per cent.; in 1909, 5,156 were vaccinated with 12.70 per cent. failures.

The proportion of failures seems to be excessive, but is not so really, for many of the failures include the vaccination of adults, who have already submitted themselves to the operation years previously.

The maintenance of a highly active vaccine lymph in the Tropics is a matter of great importance and is more difficult for obvious reasons to attain here than in a cold climate.

The vaccine supplied from the Pasteur Institute, Saigon, has proved to be generally satisfactory, failures that do occur may be attributed to the vaccine having been kept too long before use; this, unfortunately, in a place like Pahang, where long journeys have to be undertaken, is at present unavoidable.

Some authorities on tropical medicine teach that the protection from vaccination against small-pox is not as lasting in tropical as in sub-tropical regions. No immunity seems, however, to have been lost to the people in the Federated Malay States.

In the Pekan district there was in August a case of small-pox, the source of infection was, according to Dr. Leicester, the Medical Officer, Pekan, traced to the patient's husband bringing it from Marsin in Johore, where small-pox was reported to be raging. Active steps were taken to isolate the infected and all contacts were vaccinated; the Malay constable performing quarantine duty, however, contracted the disease on September 6. Both cases recovered and the outbreak terminated.

In connection with this small-pox outbreak it is interesting to note that a child aged eight months, belonging to the woman suffering from small-pox, did not contract the disease; this child had been twice before unsuccessfully vaccinated, it was again vaccinated after the mother developed small-pox but still with no result. No other cases of small-pox were reported during the year. From time to time small-pox is introduced into the Federated Malay States, generally by pilgrims returning from Mecca, but the disease is usually soon stamped out.

An outbreak of measles occurred at small villages in the Bentong district, which caused the death of eight children from, it is said, broncho-pneumonia.

This termination in the Federated Malay States is most unusual; the general experience of medical men in this part of the world is that measles in the native is a comparatively insignificant malady with no mortality.

The number of patients treated in the State hospitals during 1909 shows a reduction of 811; this may, I think, in part be accounted for by the opening of private hospitals. Hitherto a large number of coolies was sent to Government hospitals for treatment, but for the greater part of last year estates like the Pahang Rubber Company, Raub; Karak Rubber Estate, Bentong; and Loke Yew's Estate, Kuala Pahang, have had their own hospitals and dressers to treat their own sick.

The mining population round Bentong has dwindled to small proportions.

The admission into hospital of prostitutes has also much decreased.

The admissions of Malays into the State hospitals number 460, or 11.13 per cent. of the total admissions.

In Kuala Lipis 102 Malays were admitted out of a total of 701 admissions for all nationalities.

In Pekan, a purely Malay district, 40 Malays came into hospital out of 156 admitted.

A ward for Malays only is much needed in this district; if the sick Malay is to be encouraged to come into hospital a special ward must be provided for him with a separate kitchen in charge of a Malay cook. At present he is obliged to occupy the same ward as Chinese, Tamils, &c., an arrangement he considers objectionable.

PATIENTS TREATED IN THE DIFFERENT HOSPITALS, 1909.

| | | | | | |
|---|---|---|---|---|---|
| Kuala Lipis ... ... | 717 | with a mortality of | | 4·04 | per cent. |
| ,, Gaol ... | 91 | ,, | ,, | 1·09 | ,, |
| Raub ... ... .. | 1,000 | ,, | ,, | 8·05 | ,, |
| Bentong ... ... | 1,473 | ,, | ,, | 10·11 | ,, |
| Pekan... ... ... | 162 | ,, | ,, | 11·72 | ,, |
| ,, Gaol ... ... | 12 | ,, | ,, | *nil* | |
| Kuantan ... ... | 1,033 | ,, | ,, | 8·13 | per cent. |
| ,, Gaol ... | 40 | ,, | ,, | 2·05 | ,, |

RETURN OF DISEASES AND DEATHS IN 1909 AT THE FOLLOWING INSTITUTIONS:

## Kuala Lipis Hospital; District Hospitals at Raub, Bentong, Pekan and Kuantan, and Gaol Hospitals at Kuala Lipis, Pekan and Kuantan.

### GENERAL DISEASES.

| | Admissions | Deaths | Total Cases Treated |
|---|---|---|---|
| Alcoholism | 1 | 1 | 1 |
| Anæmia | 81 | 5 | 86 |
| Anthrax | — | — | — |
| Beri-beri | 384 | 42 | 449 |
| Bilharziosis | — | — | — |
| Blackwater Fever | — | — | — |
| Chicken pox | 1 | — | 1 |
| Cholera | — | — | — |
| Choleraic Diarrhœa | — | — | — |
| Congenital Malformation | — | — | — |
| Debility | 88 | 13 | 94 |
| Delirium Tremens | 1 | — | 1 |
| Dengue | 1 | — | 1 |
| Diabetes Mellitus | — | — | — |
| Diabetes Insipidus | — | — | — |
| Diphtheria | — | — | — |
| Dysentery | 261 | 46 | 272 |
| Enteric Fever | 8 | 2 | 8 |
| Erysipelas | 2 | 1 | 2 |
| Febricula | 33 | 1 | 33 |
| Filariasis | — | — | — |
| Gonorrhœa | 49 | — | 51 |
| Gout | 1 | — | 1 |
| Hydrophobia | — | — | — |
| Influenza | 9 | — | 9 |
| Kala-azar | — | — | — |
| Leprosy | — | — | — |
| (*a*) Nodular | — | — | — |
| (*b*) Anæsthetic | 2 | — | 2 |
| (*c*) Mixed | 10 | — | 10 |
| Malarial Fever— | — | — | — |
| (*a*) Intermittent | — | — | — |
| Quotidian | 101 | — | 101 |
| Tertian | 130 | 5 | 130 |
| Quartan | 12 | 2 | 12 |
| Irregular | — | — | — |
| Type undiagnosed | 871 | 32 | 907 |
| (*b*) Remittent | 1 | 1 | 1 |
| (*c*) Pernicious | 74 | 12 | 74 |
| (*d*) Malarial Cachexia | — | — | — |
| Malta Fever | — | — | — |
| Measles | — | — | — |
| Mumps | 14 | — | 15 |
| New Growths— | — | — | — |
| Non-malignant | 1 | — | 1 |
| Malignant | 2 | — | 2 |
| Old Age | — | — | — |
| Other Diseases | 16 | 3 | 16 |
| Pellagra | — | — | — |
| Plague | — | — | — |
| Pyæmia | 4 | 2 | 5 |
| Rachitis | — | — | — |
| Rheumatic Fever | 1 | — | 1 |
| Rheumatism | 100 | — | 102 |
| Rheumatoid Arthritis | — | — | — |
| Scarlet Fever | — | — | — |
| Scurvy | — | — | — |
| Septicæmia | 1 | 1 | 1 |
| Sleeping Sickness | — | — | — |
| Sloughing Phagedæna | 2 | 1 | 3 |
| Small-pox | — | — | — |
| Syphilis | — | — | — |
| (*a*) Primary | 30 | — | 31 |
| (*b*) Secondary | 32 | — | 36 |
| (*c*) Tertiary | — | — | — |
| (*d*) Congenital | 29 | — | 31 |
| Tetanus | — | — | — |
| Trypanosoma Fever | — | — | — |
| Tubercle— | 3 | 3 | 4 |
| (*a*) Phthisis Pulmonalis | — | — | — |
| (*b*) Tuberculosis of Glands | — | — | — |
| (*c*) Lupus | — | — | — |
| (*d*) Tabes Mesenterica | — | — | — |
| (*e*) Tuberculous Disease of Bones | — | — | — |
| Other Tubercular Diseases | — | — | — |
| Varicella | — | — | — |
| Whooping Cough | — | — | — |
| Yaws | 2 | — | 2 |
| Yellow Fever | — | — | — |

### LOCAL DISEASES.

| | Admissions | Deaths | Total Cases Treated |
|---|---|---|---|
| Diseases of the— | | | |
| Cellular Tissue | 111 | 8 | 120 |
| Circulatory System— | — | — | — |
| (*a*) Valvular Disease of Heart | 21 | 14 | 22 |
| (*b*) Other Diseases | 8 | 3 | 8 |
| Digestive System— | — | — | — |
| (*a*) Diarrhœa | 160 | 21 | 166 |
| (*b*) Hill Diarrhœa | — | — | — |
| (*c*) Hepatitis | 2 | — | 2 |
| Congestion of Liver | — | — | — |
| (*d*) Abscess of Liver | 3 | 2 | 3 |
| (*e*) Tropical Liver | — | — | — |
| (*f*) Jaundice, Catarrhal | 9 | 4 | 10 |
| (*g*) Cirrhosis of Liver | 4 | 1 | 14 |
| (*h*) Acute Yellow Atrophy | — | — | — |
| (*i*) Sprue | 3 | 3 | 3 |
| (*j*) Other Diseases | 135 | 11 | 137 |
| Ear | 2 | — | 2 |
| Eye | 23 | — | 24 |
| Generative System— | — | — | — |
| Male Organs | 36 | 1 | 38 |
| Female Organs | 7 | — | 8 |
| Lymphatic System | 147 | 2 | 156 |
| Mental Diseases | — | — | — |
| Nervous System | 57 | 9 | 60 |
| Nose | — | — | — |
| Organs of Locomotion | 31 | 4 | 35 |
| Respiratory System | 240 | 73 | 255 |
| Skin— | — | — | — |
| (*a*) Scabies | — | — | — |
| (*b*) Ringworm | — | — | — |
| (*c*) Tinea Imbricata | — | — | — |
| (*d*) Favus | — | — | — |
| (*e*) Eczema | 20 | — | 22 |
| (*f*) Other Diseases | 447 | 7 | 492 |
| Urinary System | 29 | 5 | 37 |
| Injuries, General, Local— | 223 | 7 | 229 |
| (*a*) Siriasis (Heatstroke) | — | — | — |
| (*b*) Sunstroke (Heat Prostration) | — | — | — |
| (*c*) Other Injuries | — | — | — |
| Parasites— | 32 | — | 35 |
| Ascaris lumbricoides | 12 | — | 12 |
| Oxyuris vermicularis | — | — | — |
| Dochmius duodenalis, or Ankylostoma duodenale | 63 | 8 | 65 |
| Filaria medinensis (Guinea-worm) | — | — | — |
| Tapeworm | — | — | — |
| Poisons— | — | — | — |
| Snake-bites | — | — | — |
| Corrosive Acids | — | — | — |
| Metallic Poisons | — | — | — |
| Vegetable Alkaloids | 4 | — | 5 |
| Nature Unknown | — | — | — |
| Other Poisons | 7 | — | 7 |
| *Surgical Operations*— | — | — | — |
| Amputations, Major | 11 | — | 13 |
| ,, Minor | | | |
| Other Operations | — | — | — |
| Eye | — | — | — |
| (*a*) Cataract | — | — | — |
| (*b*) Iridectomy | — | — | — |
| (*c*) Other Eye Operations | — | — | — |

THE PREVAILING DISEASES TREATED IN THE HOSPITALS ARE:

| | | |
|---|---|---|
| Malarial fevers... ... ... | 1,225 | with 52 deaths |
| Beri-beri ... ... ... | 449 | ,, 42 ,, |
| Dysentery ... ... ... | 272 | ,, 46 ,, |
| Diarrhœa ... ... ... | 205 | ,, 21 ,, |
| Splenitis ... ... .. | 133 | ,, 2 ,, |
| Phthisis... ... ... ... | 101 | ,, 50 ,, |
| Ankylostomiasis ... ... | 65 | ,, 8 ,, |
| Ulcer ... ... ... ... | 442 | ,, 6 ,, |

*Malarial Fevers.*—1,225 cases of malarial fever were treated with a mortality of 4.24 per cent. There were 133 cases of splenitis, and no doubt 80 per cent. of them should have been returned as chronic malaria. Each hospital is now equipped with a microscope, cover slips, slides and stains, and every endeavour is made to diagnose malaria with those aids.

The commonest type of malaria was found to be benign tertian, then the malignant tertian, and rarest the quartan.

It has been stated that the towns and villages of Pahang appear to be comparatively free from malaria. I regret that from the experience of the past year I am unable to support this statement.

The Medical Officer of Raub writes in his report of that town:—

"Malarial fever has been very prevalent, especially amongst the Europeans. Every European living within the town boundaries has suffered with more or less severity from the disease."

The Medical Officer himself and Nurse Sutton were the greatest victims. The latter was found by Sir Patrick Manson to be so "run down" from the effects of fever contracted while nursing a case in Raub previous to her departure for Europe that she was unable to return at the expiration of her leave, and was granted, in consequence, an extension of some months' duration.

The Medical Officer, Kuantan, reports that:—

"Malaria shows an increase, as is to be expected with increase of population. Considering, as a whole, I do not think that at present it can be called very malarious, though nothing is more certain with an increase of population the town of Kuantan will become excessively and dangerously malarious unless means are taken to avoid the calamity and potential menace to the prosperity of the port."

On a rubber estate about 14 miles from Bentong the coolies suffered most markedly from malaria, the infection being bigger than I have ever seen anywhere else in the Federated Malay States during the last twenty years. The largest number of admissions for any one disease into our various hospitals is from malarial fever. The cause of death from "fever" given in the registration returns amounted to 1,345 out of a total number of 3,012 deaths from all causes.

I am aware the causes in this instance are partly fallacious, but even allowing a large margin for errors there still remains a number of deaths due undoubtedly to malarial fever.

On the other hand, Kuala Lipis, the official capital, is remarkably free from malaria. No anopheline mosquitoes were discovered, although the larvæ were constantly looked for. But *Stegomyia* are abundant and are likely to increase in number, as many householders keep barrels full of water for household purposes. The sand-flies (*Simulidæ*) are prevalent and are a great nuisance, also midges (*Coratopogon*).

In July last I sent some flies to the Government Entomologist. He reports that only one of the specimens belonged to the *Simulidæ*. The other flies submitted by me he placed as belonging to the *Drosophiliæ*, and although similar flies had been despatched to England they had not been identified, and were probably new to science.

An anopheline mosquito, caught by me while in the upper reaches of the Pahang river, was identified by Dr. Stanton as *Myzorhynchus barbirostris*, probably a malaria carrier, but certainly a filarial one. A large tabanus, taken by me at the Gap, was kindly sent by Dr. Stanton to Miss Richards, who is publishing a monograph of the *Tabanidæ* of the Oriental region in the Indian Museum Records, London. She reported that it was a new species and has named it *Tabanus perakensis*. It is difficult to see why this name was chosen, as the fly was caught on the borders of Pahang and Selangor, nowhere near Perak.

*Anti-Malarial Measures.*—The travelling dispensary on the Pahang river sanctioned for this year will be an anti-malarial measure of some importance. It is hoped by this means that the free distribution of quinine will reach the large population that has not benefited hitherto; except on rare occasions, when visited by vaccinators or when an officer comes to collect rent, these inhabitants have been left very much to themselves. Regular visits by a Malay dresser will, it is hoped, alleviate a good deal of unnecessary suffering, especially among the children.

The Pahang river, extending from Kuala Lipis to near its mouth at Pekan, is about 200 miles in length and is fairly thickly populated on its banks for two-thirds of its extent. The only place between Kuala Lipis and Pekan where medical attention of any sort is obtainable is Temerloh, where a Malay dresser is stationed. He has done good work, treating 2,114 out-patients, vaccinating 351, and visiting many of the neighbouring villages and distributing medicines.

The only way to deal with the prevention of malaria in a large and undeveloped State like Pahang, is by the free distribution of quinine among the people, especially to those far away from any Government institution. The reduction of anophelines by drainage, except perhaps in a few towns, is in my opinion out of the question. At present small stocks of quinine capsules (5 gr.) are kept at the various police stations in the out-districts. The different Penghulus have been given quinine capsules with instructions printed in Malay as to how and why the quinine is given.

**Colonial Medical Reports.—No. 4.—Federated Malay States—State of Pahang**—(*continued*).

Many of the Malay schools have had capsules supplied. The leaflet containing facts about quinine and mosquitoes is read out to the pupils frequently. As far as I can judge the Malays seem to be very grateful for these efforts to reduce malarial fever among them.

Altogether 108 lb. of quinine have been used during the year and 23,500 capsules distributed.

Recently 2-gr. "tabloids" (not coated) have been distributed for the use of children.

*Beri-beri.*—Most of the 449 cases occurred at the mining centres on the East Coast, at Raub and Bentong.

There was an outbreak on a cocoanut estate at the mouth of the Pahang river, where an inferior quality of Siamese rice was supplied the coolies.

In all the Government hospitals only parboiled rice is given to the patients.

There were 272 cases of dysentery treated in our hospitals with a mortality of 16.91. An endeavour has been made to separate this disease by careful diagnosis from diarrhœa; the prevailing type of dysentery is the bacillary. There were only three cases of hepatic abscess reported, with two deaths. The one case at Lipis was operated on, and completely regaining his health is now working as a road cooly.

Two hundred and five cases of diarrhœa were treated, with 21 deaths.

Phthisis has been a very fatal disease, with 101 admissions and 50 deaths. The majority of these cases came into hospital in the very last stages.

*Ankylostomiasis.*—Up to the time of writing this report there were 77 admissions, with eight deaths. Endeavours have been made by microscopical search to find the ova of the ankylostoma, in order to estimate the prevalence of the disease among coolies admitted into the Pahang hospitals. Dr. Harrison, the Medical Officer, Kuala Kubu, from the examination of 429 cases, found the ova of the ankylostoma in 47.78 per cent. Dr. Stanton, of Kuala Lumpur Institute, found 25 per cent. of estate coolies infected, and in Kuala Lipis Hospital out of 195 cases examined 26.6 per cent. contained the ova.

So far as the Federated Malay States are interested the industrial efficiency is very much concerned by the prevalence of this disease. The conditions for its spreading outside the body in this country are ideal. We must not lose sight of the fact that every week large numbers of Indian coolies, 25 per cent. of whom at least harbour the ankylostoma, arrive in the Federated Malay States, and are scattered, carrying with them their ova, tainting new places, and helping to increase the danger in other already infected areas.

There are several degrees of infection, the "hook worm" demonstrates its presence in the body in different ways, first by loss of energy, secondly by obvious ill-health, and finally by death. Many a cooly is no doubt called lazy when really his apathy is due to mild ankylostomiasis.

The only accurate way of diagnosing ankylostomiasis is by the microscope. In the Pahang hospitals this has become a daily routine, and a special record is kept of these examinations. It is unfortunate that the more convenient way of detecting the possible presence of ankylostoma through finding *eosinophilia* is impossible in native patients.

In the Kuala Lipis Hospital many obscure cases of general malaise, slight rise of temperature, with only one or two ova of the ankylostoma under each cover slip, recovered at once after an anthelmintic had expelled 20 or 30 worms, or even less.

Massive infections cause the patient to be markedly ill with anæmia and œdema about the face, producing a very dry condition of the skin; this is very noticeable in an Indian and generally means a fatal termination. The patient has to be specially prepared by diet and purgatives before being treated; the most efficacious anthelmintic in our hands was found to be beta naphthol in 30 gr. doses every two hours, until 90 gr. had been taken; this was followed in two hours' time by a dose of castor oil.

Thymol and also chloroform and eucalyptol and castor oil mixture, recommended by Sir Patrick Manson, were tried, but found not to be as effective as the big doses of beta naphthol; the latter did not appear to produce any bad effects. But whatever drug was tried no good result would accrue unless the patient was properly prepared first.

I am unable to agree with what is taught in the chief text-books on tropical medicine, that nothing need be done for a patient passing ankylostoma ova in his excreta unless anæmia appears. It is recognized that the "female ankylostoma produces a prodigious and never-ending stream of eggs which passes out in the fæces of the host." This being so, it is obviously the duty of medical officers who have to treat coolies, especially Indians, to endeavour to expel the ankylostoma as soon as its presence is recognized, irrespective of the infection being severe or mild, or whether anæmia is present or not. I feel sure that even the presence of a few ankylostoma must be regarded as a source of danger to the cooly, who is often over-worked and ill-nourished, and whose power of resistance to disease is, therefore, much reduced, and I also realized that as long as he is passing ova he is a source of danger to others.

Frequent examinations of the fæces of the kampong Malay failed to show any ankylostoma ova. This was only to be expected when we remember that these Malays use the Pahang river and its tributaries as their latrines, for it has been found that this ova will not develop in strong running water.

*Venereal Disease.*—Every encouragement is given to the prostitutes to come to hospital for treatment. They are admitted and treated free of charge, and medicines are issued to them to take to their homes, yet, notwithstanding this generous treatment, it cannot be said that advantage is taken of it.

A most striking fact is that when this class of

woman does come for hospital treatment it is usually for illnesses other than venereal.

The Medical Officer, Kuantan, refers in his report to the hard lot of the Japanese prostitutes in Kuantan. He also writes: "I was called on urgent message to see a Chinese prostitute. When I arrived the woman was in considerable pain, but as she was quite fit to send to hospital I advised her to go, which she refused to do; as the orders of Government are so strict and unmistakable on the question of medical officers treating prostitutes in brothels I had no option but to refuse to treat."

The sanitation of Pahang is in a somewhat backward condition.

### Kuala Lipis.

The Kuala Lipis Sanitary Board consists of the District Officer as Chairman, other members of the Board being the Senior Medical Officer who is also Health Officer, State Engineer, Chief Police Officer, and two native members; there is also one overseer and five coolies for road scavenging. House refuse is not collected from the different quarters but has to be buried in the compounds. There is too much secondary jungle around most of the houses.

The water supply is from the river, and shallow surface wells, which run dry after a spell of 10-14 days without rain.

A chemical analysis of the water from these sources was made by the Government analyst, Kuala Lumpur. His report was satisfactory.

Ice cannot be obtained except at great expense from Kuala Lumpur, and in time of serious illness both the patient and medical attendant are much handicapped.

### Raub.

The water supply is somewhat of a compromise. An insufficient supply is conveyed in pipes which do not reach the Government quarters situated on hills where water has to be carried by manual labour.

The drains are mostly old and out of level, and a good many pools of water forming breeding places of mosquitoes are evident; malarial fever is very prevalent among the officials.

The number of mosquitoes within the town limits is very marked and renders the houses in the evenings most uncomfortable. I am of opinion that mosquito rooms should be provided to the different bungalows.

There is no block plan of the hospital; the buildings have been crowded together without much regard to future requirements; unfortunately, the land on the side of the hospital furthest away from the town, and the only possible direction for further extension, has been given away, in spite of opposition from the Medical Department.

### Bentong.

The sanitary condition of this town is more satisfactory; it is of comparative modern growth and has been well laid out.

The water supply is conveyed through pipes; it contains a good deal of iron, which gets deposited in cooking utensils, bath tubs, &c. It is quite wholesome, although somewhat unpalatable.

### Pekan.

The Malay capital is in much need of a proper water supply.

The hospital is a very old building, but money has been provided this year for its extension and repair.

### Kuantan

is a prosperous port on the East Coast of Pahang, and the Health Officer there says, as the town is in the course of formation, it is very important that it should grow in a proper sanitary manner. He has, therefore, devoted a considerable part of his time to sanitation. It is regrettable that the Sanitary Board of so important a town as Kuantan does not possess a sanitary inspector or a clerk of its own; much extra work has, therefore, fallen on Dr. Reid and the hospital clerk. The hospital work has suffered in consequence.

Unfortunately, a serious outbreak of disease among animals (rinderpest and swine fever) also took up a good deal of Dr. Reid's time, but in the absence of veterinary assistance it is difficult to see what else could be done. It was obviously impossible to let the outbreak take care of itself, as should the buffaloes on the Pahang river have become infected by rinderpest, the loss to Malays and to the State would have been a calamity very far-reaching in its consequences.

Mr. Ford, veterinary surgeon, Selangor, paid two visits of some duration and did what he could to prevent the spread of the cattle disease.

Owing to the difficulty of communicating with the East Coast it is not as easy to administer the department there as elsewhere, the more so as my visits to this portion of the State have been restricted to two a year.

### The Gaols.

The health of the Kuala Lipis gaol has continued its reputation as being one of the healthiest institutions of its kind in the Federated Malay States. There was only one death in a prisoner who was transferred from Kuantan suffering from advanced beri-beri.

During the year 89 patients were admitted into the hospital, and the average daily number of sick works out to 3.06, and the percentage of deaths to total treated for all diseases was 1.09.

The average daily strength in the gaol was 62.24, the available accommodation for prisoners is, roughly, 100. Five hundred and seventy-one prisoners were treated as outdoor patients, mostly for trivial ailments.

The growing of vegetables within the gaol walls for the use of the prisoners has added a good deal to their welfare, this is especially apparent in Lipis, where the food supply for the whole station is frequently deficient.

There are also small gaols at Pekan and Kuantan. the health of the prisoners at both these places has been good.

METEOROLOGICAL RETURNS.

In Kuala Lipis the rainfall for 1909 was 97.35 in., the previous year it reached 115.55 in. The greatest rainfall in twenty-four hours was 4.61 in. on February 21, 1909.

The number of days without rain in Kuala Lipis was, in 1909, 228.

The highest temperature recorded during 1909 was 96° F. on April 3, 1909, the lowest, 60° F., on August 29, 1909. The mean temperature of Kuala Lipis was 78.5.

In Raub 82.33 in. of rain fell as against 93.27 in 1908. The maximum temperature registered was 93° F. in March, April, May, and October. The lowest temperature recorded was 63° F. in February. The mean temperature at Raub was 79.5° F.

There is also a considerable amount of wind at this station in marked contrast to Kuala Lipis, where the air is generally uncomfortably still, except just a few minutes before there is rain. The moisture of the atmosphere of Kuala Lipis is without doubt greater than in any other town in the Federated Malay States.

Bentong had a rainfall of 97.82 in. and a mean temperature of 80.33° F.

Pekan had the heaviest rainfall during the year under review—*viz.*, 158.75 in. In January 32.33 in. fell. The mean temperature was 80.55° F.

Kuantan 113.99 in. fell. The mean temperature was 80.41° F.

At Temerloh, an inland station situated away from the influence of mountain ranges and from oceanic disturbances, the rainfall only amounted to 61.91 in. The mean temperature was 82.3° F.

From the returns that have recently been especially prepared to show the difference of the rainfall on the eastern and western sides of the main mountain range, the following monthly averages, based on observations for the last seven years, are submitted:—

| | September to February Inches | March to August Inches |
|---|---|---|
| Lipis | 8·57 | 6·87 |
| Raub | 9·84 | 5·76 |
| Bentong | 9·84 | 5·41 |
| Pekan | 16·47 | 6·09 |
| Kuantan | 12·32 | 5·76 |
| Temerloh | 7·45 | 4·82 |

These figures show that the towns on the East Coast during the north-east monsoon, prevailing during September to February, have a rainfall of nearly double that of the towns situated in the Ulu Pahang.

These facts should be of some value when the question of selecting a new capital is being finally considered.

## Colonial Medical Reports.—No. 4.—Federated Malay States.

### State of Negri Sembilan.

# MEDICAL REPORT FOR THE YEAR 1909.

**By J. R. LUCY,**

*Senior Medical Officer.*

THERE is undoubtedly progressive improvement in the registration of births and deaths, but the results must be considered to be to some extent fallacious.

The immigration and emigration returns include arrivals and departures by seaports only. No figures are available of the large movements of population across the boundaries of the State by railroad.

The Chinese population on December 31, 1909, is shown to be 41,433. These figures are probably greatly in excess of the actual numbers.

During the past few years there has been a steady exodus of mining coolies from all parts of the State, the number of Chinese in the mines in 1907 was 21,863, in 1908 16,994, and in 1909 12,294. These figures, compiled by the Mines Department, must be considered as approximately accurate, and indicate a rapid decline in the Chinese population.

On the other hand, the number of Indians is probably larger than is indicated in the return. There were 5,606 Indians on estates alone, and there must be at least another thousand employed as shopkeepers, or working in the police, railway, and Public Works Departments.

For a fair estimate of the condition of the public health a new census is indispensable, and a more comprehensive system of compilation of returns of population must be devised which will take cognisance of the movements of population by land as well as by sea. Without complete figures vital statistics are of little practical use and no scientific value.

RETURN OF DISEASES AND DEATHS IN 1909 AT THE FOLLOWING INSTITUTIONS:

## Seremban Hospital, Gaol Hospital, Mantin Hospital, the District Hospitals at Port Dickson, Tampin, Kuala Pilah and Jelebu, the Ayer Kuning Hospital and the Beri-Beri Hospital, Port Dickson.

### GENERAL DISEASES.

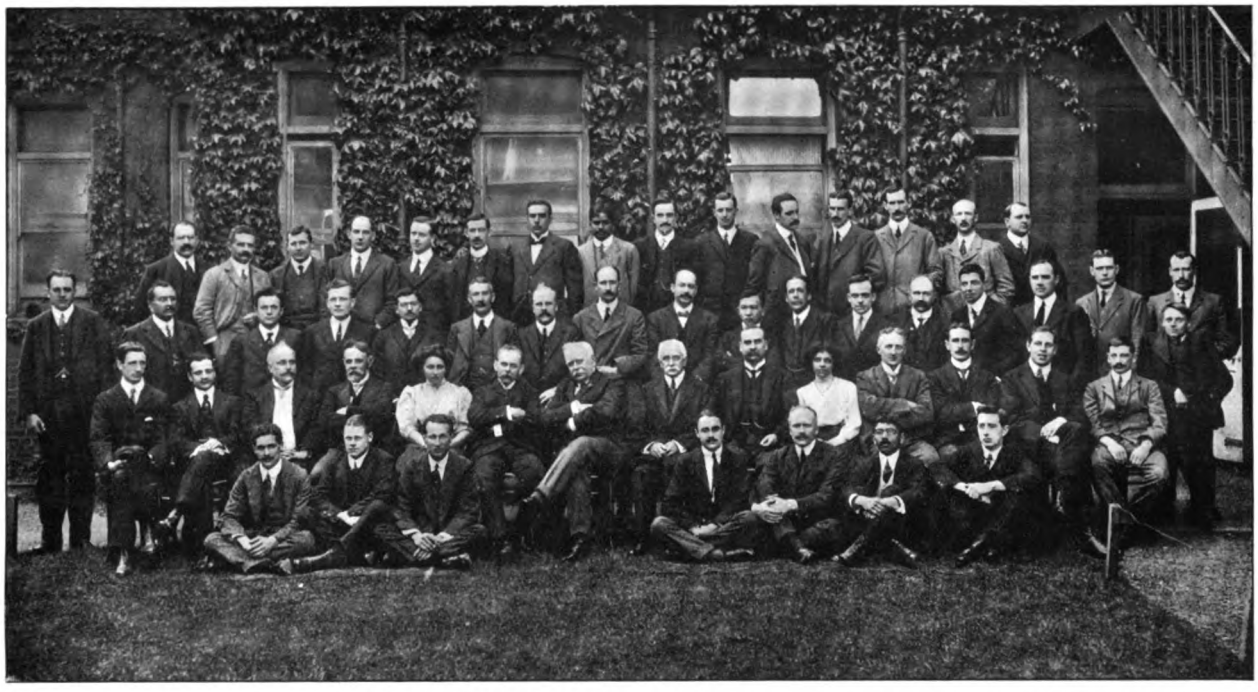
| | Admissions | Deaths | Total Cases Treated |
|---|---|---|---|
| Alcoholism | 7 | 1 | 7 |
| Anæmia | 177 | 10 | 190 |
| Anthrax | — | — | — |
| Beri-beri | 1019 | 34 | 1187 |
| Bilharziosis | — | — | — |
| Blackwater Fever | — | — | — |
| Chicken-pox | 7 | — | 7 |
| Cholera | — | — | — |
| Choleraic Diarrhœa | — | — | — |
| Congenital Malformation | — | — | — |
| Debility | 238 | 54 | 258 |
| Delirium Tremens | 1 | — | 1 |
| Dengue | — | — | — |
| Diabetes Mellitus | 2 | — | 2 |
| Diabetes Insipidus | — | — | — |
| Diphtheria | — | — | — |
| Dysentery | 971 | 229 | 1019 |
| Enteric Fever | 8 | 3 | 10 |
| Erysipelas | 8 | 1 | 8 |
| Febricula | — | — | — |
| Filariasis | — | — | — |
| Gonorrhœa | 97 | — | 100 |
| Gout | — | — | — |
| Hydrophobia | — | — | — |
| Influenza | — | — | — |
| Kala-azar | — | — | — |
| Leprosy | 10 | — | 13 |
| (*a*) Nodular | — | — | — |
| (*b*) Anæsthetic | — | — | — |
| (*c*) Mixed | — | — | — |
| Malarial Fever— | — | — | — |
| (*a*) Intermittent | — | — | — |
| Quotidian | — | — | — |
| Tertian | 1728 | 81 | 1748 |
| Quartan | 104 | 6 | 105 |
| Irregular | 93 | 7 | 93 |
| Type undiagnosed | 1224 | 41 | 1288 |
| (*b*) Remittent | 1 | 1 | 1 |
| (*c*) Pernicious | — | — | — |
| (*d*) Malarial Cachexia | — | — | — |
| Malta Fever | — | — | — |
| Measles | 5 | — | 5 |
| Mumps | 2 | — | 2 |
| New Growths— | — | — | — |
| Non-malignant | 7 | — | 7 |
| Malignant | 5 | 3 | 6 |
| Old Age | — | — | — |
| Other Diseases | 10 | 1 | 11 |
| Pellagra | — | — | — |
| Plague | — | — | — |
| Pyæmia | 1 | 1 | 1 |
| Rachitis | — | — | — |
| Rheumatic Fever | 2 | — | 2 |
| Rheumatism | 292 | 1 | 320 |
| Rheumatoid Arthritis | — | — | — |
| Scarlet Fever | — | — | — |
| Scurvy | — | — | — |
| Septicæmia | 6 | 4 | 6 |
| Sleeping Sickness | — | — | — |
| Sloughing Phagedæna | 57 | 3 | 58 |
| Small-pox | — | — | — |
| Syphilis | — | — | — |
| (*a*) Primary | 31 | — | 33 |
| (*b*) Secondary | 50 | — | 56 |
| (*c*) Tertiary | 109 | 1 | 112 |
| (*d*) Congenital | — | — | — |
| Tetanus | — | — | — |
| Trypanosoma Fever | — | — | — |
| Tubercle— | 5 | — | 5 |
| (*a*) Phthisis Pulmonalis | — | — | — |
| (*b*) Tuberculosis of Glands | — | — | — |
| (*c*) Lupus | — | — | — |
| (*d*) Tabes Mesenterica | — | — | — |
| GENERAL DISEASES—*continued.* | | | |
| (*e*) Tuberculous Disease of Bones | — | — | — |
| Other Tubercular Diseases | — | — | — |
| Varicella | — | — | — |
| Whooping Cough | — | — | — |
| Yaws | 5 | — | 6 |
| Yellow Fever | — | — | — |

### LOCAL DISEASES.

| | Admissions | Deaths | Total Cases Treated |
|---|---|---|---|
| Diseases of the— | | | |
| Cellular Tissue | 254 | 28 | 283 |
| Circulatory System— | — | — | — |
| (*a*) Valvular Disease of Heart | 32 | 5 | 34 |
| (*b*) Other Diseases | 26 | 7 | 27 |
| Digestive System— | — | — | — |
| (*a*) Diarrhœa | 114 | 24 | 118 |
| (*b*) Hill Diarrhœa | — | — | — |
| (*c*) Hepatitis | 13 | — | 13 |
| Congestion of Liver | — | — | — |
| (*d*) Abscess of Liver | 4 | 1 | 5 |
| (*e*) Tropical Liver | — | — | — |
| (*f*) Jaundice, Catarrhal | 16 | 2 | 17 |
| (*g*) Cirrhosis of Liver | 35 | 17 | 35 |
| (*h*) Acute Yellow Atrophy | — | — | — |
| (*i*) Sprue | — | — | — |
| (*j*) Other Diseases | 236 | 17 | 242 |
| Ear | 11 | — | 12 |
| Eye | 59 | — | 67 |
| Generative System— | — | — | — |
| Male Organs | 177 | 2 | 187 |
| Female Organs | 9 | 1 | 9 |
| Lymphatic System | 245 | 3 | 268 |
| Mental Diseases | — | — | — |
| Nervous System | 97 | 17 | 118 |
| Nose | — | — | — |
| Organs of Locomotion | 51 | 4 | 58 |
| Respiratory System | 676 | 203 | 706 |
| Skin— | — | — | — |
| (*a*) Scabies | — | — | — |
| (*b*) Ringworm | — | — | — |
| (*c*) Tinea Imbricata | — | — | — |
| (*d*) Favus | — | — | — |
| (*e*) Eczema | 61 | — | 61 |
| (*f*) Other Diseases | 2033 | 3 | 2201 |
| Urinary System | 159 | 48 | 183 |
| Injuries, General, Local— | 320 | 8 | 349 |
| (*a*) Siriasis (Heatstroke) | — | — | — |
| (*b*) Sunstroke (Heat Prostration) | — | — | — |
| (*c*) Other Injuries | — | — | — |
| Parasites— | — | — | — |
| Ascaris lumbricoides | 32 | — | 34 |
| Oxyuris vermicularis | — | — | — |
| Dochmius duodenalis, or Ankylostoma duodenale | 105 | 13 | 112 |
| Filaria medinensis (Guinea-worm) | — | — | — |
| Tapeworm | — | — | — |
| Poisons— | — | — | — |
| Snake-bites | — | — | — |
| Corrosive Acids | — | — | — |
| Metallic Poisons | — | — | — |
| Vegetable Alkaloids | 8 | — | 8 |
| Nature Unknown | — | — | — |
| Other Poisons | 2 | — | 3 |
| *Surgical Operations*— | 4 | 1 | 4 |
| Amputations, Major | — | — | — |
| ,, Minor | | | |
| Other Operations | — | — | — |
| Eye | — | — | — |
| (*a*) Cataract | — | — | — |
| (*b*) Iridectomy | — | — | — |
| (*c*) Other Eye Operations | — | — | — |

## LONDON SCHOOL OF TROPICAL MEDICINE.

**36th Session. May-July, 1911.**



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# LONDON SCHOOL OF TROPICAL MEDICINE

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**Under the Auspices of His Majesty's Government,**

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**LECTURES AND DEMONSTRATIONS DAILY BY MEMBERS OF THE STAFF.**

There are three Sessions yearly of three months each, viz., from October 1st to December 31st, from January 15th to April 14th, and from May 1st to July 31st inclusive. Women Graduates are received as Students.

Certificates are granted after Examination at the end of each Session, and the course is accepted by Cambridge University as Qualifying for Admission to their Examination for the Diploma in Tropical Medicine and Hygiene, and by London University as Study for the M.D. in Branch VI. (Tropical Medicine).

**Fee for course £16 16s.; shorter periods by arrangement.**

Students can be provided with Board and Residence, or partial Board, at the School.

**Medical men requiring posts in the Tropics may apply to the Secretary at the School, where a Register is kept.**

A syllabus, with the general course of study, can be had on application to the undersigned, from whom further information may be obtained.

Students of the London School of Tropical Medicine, who join the London School of Clinical Medicine, will be allowed an abatement on their fees and *vice versâ*.

*Chief Office*—SEAMEN'S HOSPITAL, GREENWICH, S.E.

**Colonial Medical Reports.—No. 4.—Federated Malay States—State of Negri Sembilan** (*continued*).

The subjoined return gives the birth-rate and death-rate *per mille* for all nationalities.

BIRTH- AND DEATH-RATE PER 1,000 LIVING.

| | Europeans and Eurasians. | Chinese. | Malays. | Indians. | Others. | Total population. |
|---|---|---|---|---|---|---|
| Birth-rate, 1909 | 13 | 8 | 35 | 22 | 65 | 25 |
| Death-rate, 1909 | 11 | 38 | 27 | 198 | 234 | 40 |

The Malay birth-rate remains high, and there is a material improvement in their death-rate.

The total numbers of births and deaths for all nationalities during the past three years is shown below:—

BIRTHS.

| | Malays. | Chinese. | Indians. | Europeans and Eurasians. | Others. | Total. |
|---|---|---|---|---|---|---|
| 1907 | 2,565 | 318 | 83 | 20 | 24 | 3,010 |
| 1908 | 2,557 | 321 | 106 | 17 | 24 | 3,025 |
| 1909 | 2,459 | 356 | 156 | 17 | 24 | 2,996 |

DEATHS.

| | Malays. | Chinese. | Indians. | Europeans and Eurasians. | Others. | Total. |
|---|---|---|---|---|---|---|
| 1907 | 1,989 | 1,991 | 1,277 | 10 | 58 | 5,267 |
| 1908 | 2,174 | 2,097 | 1,127 | 9 | 59 | 5,466 |
| 1909 | 1,887 | 1,625 | 1,188 | 14 | 86 | 4,808 |

No cases of grave zymotic disease came under observation during the year.

Small outbreaks of measles and chicken-pox occurred. They call for no special notice.

STATE HOSPITALS AND PREVAILING DISEASES.

There were 12,050 persons treated as in-patients in the various Government hospitals. This total is less by 834 than that for the previous year.

The daily average number of patients in all hospitals was 678, as compared with 773 in 1908.

The decline in the number of in-patients was observed principally at Seremban hospital.

Subjoined return gives the number of in-patients treated at all hospitals, together with the death-rate:—

| | Total treated. | Deaths. | Mortality. |
|---|---|---|---|
| 1909 | 12,050 | 881 | 7·31 |

Of the 881 deaths, 190, or over 21 per cent. of the total, died within forty-eight hours after admission. Exclusive of these 190 cases the death-rate for the year in all hospitals was 5.82 per cent.

Return of diseases more commonly treated with percentages of deaths during 1908 and 1909:—

| Disease. | Number treated. | | Number of deaths. | | Percentage of deaths. | |
|---|---|---|---|---|---|---|
| | 1908. | 1909. | 1908. | 1909. | 1908. | 1909. |
| Beri-beri | 2,131 | 1,187 | 158 | 34 | 7·41 | 2·86 |
| Dysentery | 1,253 | 1,019 | 455 | 229 | 36·31 | 22·47 |
| Diarrhœa | 302 | 118 | 93 | 24 | 30·79 | 20·33 |
| Malarial fever | 3,610 | 3,235 | 158 | 136 | 5·24 | 4·20 |
| Debility | 337 | 258 | 71 | 54 | 21·06 | 20·93 |
| Pulmonary disease | 482 | 704 | 158 | 203 | 32·78 | 28·83 |
| Other diseases | 5,369 | 5,529 | 220 | 201 | 4·09 | 3·63 |
| Total | 12,884 | 12,050 | 1,313 | 881 | 1·019 | 7·31 |

Malarial fever, as usual, produced the largest number of admissions, over 26 per cent. of the total being due to this disease in one form or another.

Beri-beri acounts for 1,187 cases treated, with a mortality of 2.86 per cent., excluding 14 cases which died within forty-eight hours of admission, the death-rate is 1.70 per cent. It may be said that the exclusion of uncured rice from the dietary of beri-berics is almost as valuable a curative measure as is its exclusion from the dietary of healthy persons a preventative against the incidence of the disease.

Pulmonary diseases produced the highest case-mortality—704 cases, with a death-rate of over 28 per cent. Under the classification is included pulmonary tuberculosis with 248 cases and 119 deaths, and pneumonia, 139 cases and 68 deaths. This latter disease, frequently complicated with malignant malaria, has been particularly fatal.

VACCINATION.

By the close of the year there were forty-nine schoolmasters in various districts of the State capable of performing vaccinations.

Vaccinations and inspections are usually performed in the school-houses on Friday in each week.

There were 6,737 person vaccinated, and of these 5,728, or 85 per cent., were successful.

The *gurus* vaccinated 6,476 persons, the remaining 261 being vaccinated by the medical staff.

Some experiments were made with samples of desiccated and lanolinated lymph from England, but the results did not compare favourably with those obtained with the glycerinated lymph from Saigon.

## Colonial Medical Reports.—No. 5.—Antigua.

# MEDICAL REPORT FOR THE YEAR 1909.

**By FRANK OLIPHANT, M.B., C.M.Edin.**

*Medical Officer, District I.*

THE number of persons attended in District 1 during the year 1909 was 4,494, of whom 137 died.

In 1908, 6,374 persons were attended to, of whom 114 died.

In 1907, 6,021 were attended to, of whom 89 died.

From these figures it will be seen that fewer persons were seen than in both 1907 and 1908, but

that the death-rate of 1909 was higher than in the two preceding years.

There was no serious epidemic during the year.

The number of cases of malarial fever treated during the year was 155, against 391 in 1908, and 254 in 1907. The first half of the year supplied 137 of the cases—a large majority—such was the case in 1908, when 245 cases occurred in the first half of the year. I think that the cooler wind chills the bodies of those who are badly clothed and fed and leads to relapses of the already infected. When the sugar crop begins to be taken off and more money comes into circulation the powers of resistance of the lower classes to attacks of "fever" are increased.

There were 639 cases of animal parasites, chiefly the round worm (*Ascarides*)—an average number. But nearly every child of the working classes, and many adults, harbour these or other parasites. Filariasis is included under this head. This disease, too, is very prevalent, and leads to acute attacks of fever and ague, which may be diagnosed as malaria, if there are no local and external signs of inflammation, it is also the cause of much permanent deformity and disablement when it involves the lower extremities and urinary organs. The populace still ascribe the attacks of lymphangitis, which occur in this disease, to "chill" and have not yet grasped the true source of infection—the infected mosquito.

Tuberculous disease provides twenty cases with ten deaths. I believe tuberculosis is on the increase, but cases are advanced when seen—the abhorrence of breathing fresh air during the night is responsible for infection in this island, which should be a health resort for the tuberculous.

Syphilis and other venereal disorders are prevalent, as I have often stated before, the result of indiscriminate sexual intercourse.

Diseases of the nervous system number 272 cases. Many of these are the result of syphilis. A large number are neuralgias due to rheumatism or disorders of digestion.

There were 191 cases of diseases of the circulation; (1) Heart disease caused by rheumatism and syphilis; and (2) Anæmias due to innutrition and infection by parasites.

Diseases of the respiratory system number 843—mostly cases of epidemic catarrh.

Diseases of the digestive system total 859 cases with 47 deaths, against 1,225 cases with 25 deaths in 1908, and 1,371 with 23 deaths in 1907. The majority of the cases and deaths are in children under two years of age, and are due to neglect on the part of the parent to provide proper food and clothing.

Diseases of the bones and joints—number of cases 423—are mostly of rheumatic origin, the majority being cases of mild muscular rheumatism. Acute rheumatism with hyperpyrexia I have never seen, but subacute rheumatism with moderate pyrexia is common.

Under the head of diseases of the skin are included chronic ulcers, arising through neglect or the application of filth to fresh wounds, through ignorance and the advice of the "old women" of the community. These ulcers lead to much suffering and disablement.

A large number of persons have suffered from impetigo contagiosa and scabies, of which epidemics frequently occur.

The total number of cases attended for the past three years, and the number of deaths from various diseases is as follows:—

1907, 6,021 persons were attended to, of whom 89 died; 1908, 6,374 persons were attended to, of whom 114 died: 1909, 4,401 persons were attended to, of whom 137 died.

The sanitary condition of the city has been maintained by the City Commissioners. Improvements, such as the filling up of ponds—in the Deanery grounds, and at the Point—the construction of new concrete side drains to several streets, and precautionary measures taken against the breeding of mosquitoes, have been efficiently carried out.

## Colonial Medical Reports.—No. 6.—Jamaica.

# MEDICAL REPORT FOR THE YEAR ENDED MARCH 31, 1909.

**By J. ERRINGTON KER.**

*Superintending Medical Officer.*

### VACCINATION.

THE returns on following page show the number of vaccinations performed during the year as well as during some preceding years.

No arm-to-arm vaccination takes place now in the Public Service. Lymph is obtained from the Jenner Institute in London, and is received fortnightly.

Although the younger generation are efficiently protected against small-pox, the same cannot be said for the adult population.

It is absolutely necessary, as a sanitary measure, that every person should be re-vaccinated, at least once; twice would be safer, as one vaccination in childhood cannot be said to protect against small-pox for a lifetime.

*Payments for Vaccination.*

| Year | Successful | Unsuccessful | Did not return | Registrars | Totals |
|---|---|---|---|---|---|
| | | | £ s. d. | £ s. d. |
| 1900-1 | 15,488 | 525 | 461 | .. | 943 8 8 |
| 1901-2 | 14,471 | 680 | 300 | .. | 884 2 7 |
| 1902-3 | 26,596 | 737 | 418 | .. | 1,560 18 8 |
| 1903-4 | 18,530 | 434 | 305 | .. | 1,547 16 11 |
| 1904-5 | 21,891 | 526 | 355 | .. | 1,540 1 4 |
| 1905-6 | 29,112 | 625 | 468 | .. | 1,672 1 7½ |
| 1906-7 | 24,470 | 404 | 345 | 245 10 5 | 1,907 10 11 |
| 1907-8 | 22,916 | 524 | 392 | 220 9 8 | 1,372 19 5 |
| 1908-9 | 21,662 | 705 | 562 | 226 0 1 | 1,451 2 9 |

One only needs to see the results of want of vaccination in countries like Spain or Morocco to realize the value of it.

YAWS.

The large increase in the number of cases of yaws treated this year is evidently due to the fact that Law 22 of 1908 has had the effect of making the yaws cases come out more than formerly.

The treatment of yaws, however, will always be unsatisfactory until some system of segregation or compulsory treatment can be introduced and kept in force, the former being by far the best. The people are indifferent to treatment, and look upon the disease as one that every child must go through, and so pay little attention to it.

QUARANTINE.

During the past year the following places or parts thereof remained under proclamation :—

Brazil—All the ports of which were proclaimed for small pox and yellow fever.

Caribbean Ports of Costa Rica and Panama between and inclusive of Points Caretta and Rincon, which were proclaimed for small-pox.

Mazatlan—in Mexico.

The colony of Trinidad was proclaimed for yellow fever between April 1 and April 23, 1908, and was again proclaimed for plague between July 1 and December, 1908.

The colony of Barbados was proclaimed for yellow fever on January 29, 1909, and at the end of the Financial Year was still under proclamation.

During the past year a portion of the Quarantine Station Hospital was provided with wire gauze—two small rooms to hold five persons being thus provided. During the present year the whole hospital will be mosquito netted ; and, later on, the whole institution may need to be so treated.

PUBLIC GENERAL HOSPITALS.

The work at these hospitals has again to be distinguished by its generally first-class character and by good results, especially in surgery.

ANNOTTO BAY HOSPITAL.

The " daily average " of this hospital has been the largest on record, as far as I can tell, of any public general hospital in Jamaica, namely, 169 per day as against 124 last year, while the number of admissions has beaten any previous record, having been 5,338 as against 4,651 of the previous year. This hospital although nominally allowed or fitted up for a total all told of 140 patients per day, has frequently had over 200 per day and on January 14, 1909, had 233 in one day.

Fortunately, the Panama tents came to the rescue as did also the cots sent up at the time of the earthquake. Tents and cots have been in use during the whole year without a break owing to the great influx of coolies consequent upon new arrivals from Calcutta. This continuous increase naturally caused increase in the staff of the hospital, not shown, however, on the annual estimates inasmuch as they increase or decrease with the number of patients to be treated. His Excellency the Governor appointed a select committee to enquire into the matter of hospital accommodation in the parishes of Portland and Saint Mary.

PORT ANTONIO HOSPITAL.

In the year 1907-8 this hospital made a record both in the number of its admissions to hospital and also in its " daily average." Last year, however, it beat both its previous records.

Both Drs. Moseley and Ritchie have had very hard work, and are to be congratulated on having gone through it so successfully.

PORT MARIA HOSPITAL

Was very much pressed for room during the last few months of the year gone by owing to the arrival, near the end of the year, of a new batch of coolies.

HORDLEY HOSPITAL.

It is pleasant to relate that the Public Works Department have now nearly finished the new male ward which is to, partially, replace those destroyed by the hurricane. When completed, it will be one of the best wards outside Kingston, and it has an excellent underbuilding which, in time of stress, may be used as an underbuilding ward. The new operating room is a very neat little place and Dr. Evans, with his fondness and ability for surgery, will doubtless make good use of it. The Jamaica Estates Company, that owns a spring close by which has provided water for the hospital now for a long time, have kindly consented for a nominal sum and on easy conditions to allow a pump to be placed so that water can be raised to the level of a cistern at the highest part of the hospital. This will be a great boon.

CHAPELTON HOSPITAL.

The work at this hospital has been somewhat handicapped during the last three months of the year owing to the Public Works Department having taken over the whole of the main building wards. The female ward meanwhile has been given to the male patients, and three tents were erected for the female patients.

ULCERS.

One thing that strikes the casual observer of cases in the hospitals is the very large number of ulcers of the leg that one sees among coolies, especially among those who have recently come to the island, and in some hospitals among creoles also.

These ulcers often incapacitate those suffering from them for some long time, and are more often than not due to insects, neglect and syphilis.

MALARIA.

With regard to malaria, one may say that a great deal can be done by individuals in getting rid of it if only they will destroy the various breeding places of the Anopheles variety of mosquitoes in their own back yards and on their own premises. Parochial Boards can also help in this matter by insisting that all those living within their towns and villages shall keep their premises in a sanitary condition and by themselves keeping the said towns and villages sanitary (that is clean and dry and free from filth of all sorts; and rid of all places where mosquitoes may breed—puddles, ponds, pools, and other collections of water, &c.).

SANITATION.

During my last vacation, at His Excellency Sir S. Olivier's request, I went through the Jamaica and English Health Laws and drew up a rough code so as to make the Jamaica laws run on the same lines as far as possible as the English ones, bringing them up to date. There was not time for the late Hon. Attorney General to get it ready for the last Session of Council and consequently it has had to wait. However, a useful code of laws will certainly be ready for the consideration of the Legislative Council at next Session.

All these Health Laws appear to have been made on the principle "that one should not have too much of a good thing all at once."

Personally it seems to me that the English Laws made to suit Jamaica by the addition of a few local necessities are the best that could be provided.

The only real difference between a good English code and what is necessary here is a good set of Bye-Laws on "Nuisances" to suit local conditions and power to enforce new works where necessary, otherwise the English Law is excellent—having been well thought out by a series of Health Officers of acknowledged ability.

The question of sanitation is one in which every person in this Island should take an individual interest. A great deal has been heard, during the past year, about plague and yellow fever.

Both Trinidad and Barbadoes and more recently British Guiana have had yellow fever, while Trinidad and Venezuela have had plague.

(1) Had there been no mosquitoes of the *Stegomyia fasciata* type in Trinidad and Barbadoes and British Guiana there would never have been any yellow fever there. The obvious remedy therefore, or rather safeguard, is to prevent the mosquito breeding. As this variety of mosquito lives to a great extent about and around houses, especially those that have cisterns, the best thing to do is to clear out premises of mosquitoes by destroying their breeding places and destroying the insect also.

(2) Again, had there been no rats and mice with their fleas in Trinidad there would never have been any plague there, in all probability, except an isolated case or two, introduced from outside.

The remedy or safeguard for plague therefore is to kill all vermin, within our ports, towns and villages, and this is a thing that every householder can do himself.

If mosquitoes and vermin are got rid of, we can then afford to ignore plague and yellow fever, except a few imported cases.

With regard to plague it cannot be too seriously impressed on shippers and merchants that they should on no account import goods from any country infected by plague. It may be said that "as long as the Quarantine Board shuts the door all is right"—but there are "indirect methods" which being the most subtle are the most dangerous. What is to prevent a Trinidad or Venezuelan merchant who wants to send his goods to Jamaica forwarding them "via New York or elsewhere" and asking his agent to re-address them for Jamaica as coming from New York and not from Trinidad or Venezuela.

This is a very serious danger that has to be looked in the face and all importers should be very careful simply for the sake of the island.

BACTERIOLOGIST.

Once more the necessity for having a bacteriologist attached to the Department must be called attention to. The bacteriologist should be a medical man and able to run bacteriology and medical science in harmony.

Having a bacteriologist centrally placed in the public hospital, Kingston, would be of distinct advantage, inasmuch as every supernumerary medical officer who acted there temporarily could learn the principles of bacteriology if he did not already know them and could perfect himself if he did, while the dispensary students who are often drafted off to Public General Hospitals could also become acquainted with the science and make themselves doubly useful in after life.

Demerara and Trinidad have bacteriologists and Jamaica with about thrice the population has not got one.

Private practitioners should be encouraged to send specimens for examination and with this in view nothing beyond cost price should be charged for ordinary examinations.

TYPHOID FEVER AND SANITATION IN KINGSTON.

Perhaps, although it is out of my province to say anything about Kingston, nevertheless, inasmuch as an epidemic of typhoid has been going on now for some time past, some remarks on the subject may not be out of place. The following figures may throw some light on the subject, as they reveal a state of affairs that ought not to be allowed to exist and which, probably, tends to increase the extent of the outbreak although not the incipient cause.

**Colonial Medical Reports.—No. 6.—Jamaica** (*continued*).

DEATHS IN KINGSTON.

| | 1900-1 | 1901-2 | 1902-3 | 1903-4 | 1904-5 | 1905-6 | 1906-7 | 1907-8 | 1908-9 |
|---|---|---|---|---|---|---|---|---|---|
| Enteric fever .. | 11 | 16 | 25 | 30 | 64 | 40 | 25 | 100 | 101 |
| Undistinguished fever | 46 | 65 | 33 | 54 | 71 | 88 | 69 | 62 | 62 |

DEATHS IN ST. ANDREW.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Enteric fever .. | 4 | 11 | 4 | 3 | 4 | 1 | 2 | 5 | .. |
| Undistinguished fever | 134 | 173 | 103 | 182 | 144 | 165 | 165 | 241 | .. |

It is very evident from the above that many cases of death from "fever" take place that are not diagnosed and consequently many of them may be enteric (or typhoid) fever.

I understand that only seventeen of the sixty-two deaths from undistinguished fever in the year 1908-9 in Kingston were reported by medical men. The consequence is that a large margin of deaths of persons from "undistinguished fevers" remain that had probably had no medical treatment whatever, and all, or many, of which may have been typhoid cases capable of infecting others. Probably the same percentage of medically unattended cases occurred in each of the various years mentioned, leaving about two-thirds in each year practically unattended and unrecorded.

The result of this is, of course, that neither clothing, bedding, utensils or discharges of many patients who have been suffering probably from typhoid have been disinfected, while the contaminated clothes, bed-linen and utensils have been used to infect other people.

SUMMARY OF WORK DONE.

*Diseases of the Skin* show a total of 2,740 cases and 5 deaths.

Ulcers of the lower limbs, which are often in the first place due to insect bites, but which, owing to neglect, develop into troublesome ulcers, account for many admissions. Syphilis and uncleanliness also have their quota.

*Parasites* show a total of 170 cases, of which 19 cases were due to *Ankylostoma duodenale*. This is a disease that is common among coolies, and to which much attention has recently been called, and which, were a bacteriologist available, would likely prove to be much more prevalent than it is believed to be.

*Diseases of the Digestive System* show 1,326 cases and 52 deaths.

*Diseases of the Respiratory System* show 522 cases and 50 deaths.

*Syphilis* shows as follows:—Primary cases, 121; secondary cases, 83; tertiary cases, 28; inherited cases, 25; undistinguished cases, 2. Total, 467 cases with 8 deaths.

Dr. Meikle, of the Newport District, in his Annual Report, states that there was a regular epidemic of venereal disease in the months of June, July, August, and the infection seemed to have been introduced by the labourers returned from the Isthmus of Panama, Syphilis in its primary and secondary stages being very evident. Syphilis, the same District Medical Officer, states, is a very common disease in Southern Manchester, more especially in certain districts.

*Malaria.*—Under this heading 7,455 cases were treated in hospital with 77 deaths against 6,844 cases and 89 deaths last year. The return is as follows:—

| | Cases |
|---|---|
| Variety Intermittent .. .. .. .. | 5,001 |
| ,, Remittent .. .. .. .. | 813 |
| ,, Pernicious .. .. .. .. | 23 |
| ,, Undistinguished .. .. .. | 1,613 |
| | 7,455 |

*Tetanus.*—Shows 11 cases and 7 deaths.

*Rheumatism.*—Shows 691 cases.

*Rheumatic Fever.*—Shows 6 cases only.

*Anæmia.*—Shows 172 cases and 13 deaths.

How many of these cases may have been due to *Ankylostoma duodenale?*

*Alcoholism.*—Shows only one case, a marvellous record for the year, speaking volumes for the sobriety of the nation.

Kingston, April 26, 1909.

Speaking generally, the health of the Kingston District during the period under review was fairly good—a marked improvement on that of the preceding twelve months. There was no epidemic of any kind to chronicle, and the mortality, both as regards the actual number of deaths, as well as the mean average death-rate (34·22 per 1,000), was considerably lower than in the previous year. This is a matter for gratitude and congratulation. But there are some diseases which bulk largely in the sick list to which I shall allude later on—preventable diseases which ought to be prevented or reduced in frequency, or at all events combated with greater vigour, intelligence, and determination than are at present exercised.

The first point touching the public health to which I desire to refer is the prolonged drought continued from the previous year which prevailed almost without interruption and with marked severity during 1908-9. The total rainfall for the year was 25·2, as against an annual average for the city of 35·29. Drought in Kingston is of very serious moment to the sanitarian. It means disease with its attendant suffering and death. The dust nuisance, the usual and necessary concomitant of dry weather, was simply terrible, and was undoubtedly a potent factor in the causation of diseases of various kinds: cutaneous, digestive, pulmonary and specific. There can be no question that the water supply of Kingston is totally inadequate. To say that the supply from Hope and Constant Spring is sufficient is absolutely misleading. It is true that these sources afford an abundance of water for all purposes, and some to spare when the wet season is on, but soon after the rains hold up the supply gives out. What is required is a regular, constant, adequate, dependable supply, and until this is permanently obtained, the city will never be free from the risks of a water famine with its attendant evils, danger to public health and sanitation being the chief. And I may here point out that with the extension of the water-carriage system, which it is to

be hoped will be taken in hand without much longer delay, there will be the necessity for a still larger amount of water per head of the population than there is at present; and unless this want is properly met, it requires no prophet to foretell what will happen.

In my report for last year I called attention to the prevalence of phthisis and enteric fever in Kingston, and I entertained the hope that I would have been able to indicate some improvement in this respect during the year now under discussion, but I regret to say I am unable to do so. Both diseases maintained their firm grip on the city. As regards phthisis, 201 deaths were registered as caused by this disease. I wish I could feel convinced that these figures accurately represent the case-incidence, and mortality of tuberculosis during 1908-9, but I am not at all satisfied that this is the case—indeed, I am strongly tempted to think that they are on the small side. In view of this, can it be seriously maintained that we are doing all that we can, or ought to do, to counteract the ravages of this terrible scourge, which may be regarded as to a great extent preventable? To me it appears that we have not yet taken the first step in the contest. We must know the haunts of the enemy before we can hope to engage and overcome him. It seems that the time has arrived when phthisis should be placed on the list of notifiable diseases.

A point in connection with tuberculosis, to which I desire to direct attention, is the milk supply. It is a question whether milk derived from a tuberculous animal, so long as there is no tubercular disease of the udder, is dangerous to the consumer, though sterilization as a precautionary measure is distinctly to be recommended: but where disease of the udder exists, the danger of infection is beyond question, and so it seems only right that udder diseases should be made notifiable, and systematic inspection of dairy cows by veterinarians insisted on.

*Enteric Fever.*—This disease was very prevalent during the year, especially in the first half, and at one time almost threatened to become epidemic. Two hundred and forty-five cases were reported, as compared with 197 cases in the preceding year. It was not confined to any particular part or parts of the city, but occurred sporadically at many points. Diligent search failed to locate the source. The question of human "carriers" was carefully inquired into, but did not give any conclusive results. My opinion is that the two primary causes of enteric fever in Kingston are:—

(1) The filthy latrines which serve about three-quarters of the city, and

(2) The clouds of dust which float about during dry and windy weather—of course the remedy for these conditions is obvious, and should be adopted soon as possible—the extension of the water-carriage system and the proper sprinkling of the streets.

Several cases of mumps, chiefly among the police, were met with, but presented no features calling for comment.

There was quite an outbreak of influenza during the quarter ended December 31, 1908, and in several instances pneumonia supervened as a complication. The mortality, however, was not high.

*Malarial Fever.*—I am glad to report that this disease was not very prevalent during the year. I think, however, that malarial fever could be completely banished from Kingston if the inhabitants would be more careful to see that no breeding places for mosquitoes are tolerated in the city. All drains should be lined with cement, and no stagnant pools allowed. These precautions, combined with the natural atmospheric conditions of Kingston, should succeed in entirely eliminating malaria from the city.

*Infantile Mortality.*—The drain on the population resulting from the large number of deaths among children below the age of 5 years is enormous and is distressing to contemplate. Many causes seem to be at work in bringing about this serious state of affairs. Illegitimacy is, of course, a factor; but I do not think, in view of the practice in Jamaica of what one may term permanent faithful concubinage, as distinguished from promiscuous intercourse between the sexes, that illegitimacy plays as prominent a part in child mortality here as it does in more advanced countries, where in some instances the death-rate among illegitimate children is about double that of children born in wedlock. I believe the chief danger to child life here is improper feeding and sheer downright ignorance on the part of mothers of the most elementary rules of nursing and tending their offspring.

*Vaccination.*—Nine hundred and seventy cases were performed. This represents a fair proportion of the children born. As far as children are concerned, Kingston may be said to be fairly well protected against small-pox, but the same assertion cannot be made as regards adults in the absence of re-vaccination.

LAWSON GIFFORD, D.M.O.

Halfway-Tree, May 12, 1909.

I regret to have to note that sporadic cases of enteric have occurred almost weekly. I attribute this to bad sanitary surroundings, to clouds of dust and perhaps to house flies.

*District.*—I am glad to be able to report that the Parochial Board has now obtained a sprinkler, but the chief sources of insanitation, viz., the Sandy gulleys, ponds, and yard premises are still untouched.

There are no public latrines. The country people use the gulleys as such, and pools of foul water are in these at all times of the year, except after heavy rains.

*Alms House.*—The Alms House has been visited daily and operations performed, inmates treated, midwifery cases attended, and lunatics certified when necessary. The condition of this institution needs some comment.

The buildings are in bad repair. Some of the wards are badly ventilated and over-crowded. There is a conspicuous absence of paint and whitewash and a want of tidiness in some of the wards. In this respect, the female side compares favourably with the male. The nurses are not in uniform. It is some-

RETURN OF DISEASES AND DEATHS IN 1908 AT THE PUBLIC GENERAL HOSPITALS AT

**Morant Bay, Hordley, Port Antonio, Buff Bay, Annotto Bay, Port Maria, St. Ann's Bay, Cave Valley, Falmouth, Montego Bay, Lucea, Sav-la-Mar, Black River, Mandeville, Chapelton, Lionel Town and Spanish Town, Jamaica.**

## GENERAL DISEASES.

| | Admissions | Deaths | Total Cases Treated |
|---|---|---|---|
| Alcoholism | 1 | — | 1 |
| Anæmia | 172 | 13 | 172 |
| Anthrax | — | — | — |
| Beri-beri | — | — | — |
| Bilharziosis | — | — | — |
| Blackwater Fever | — | — | — |
| Chicken pox | — | — | — |
| Cholera | — | — | — |
| Choleraic Diarrhœa | — | — | — |
| Congenital Malformation | — | — | — |
| Debility | 48 | — | 48 |
| Delirium Tremens | — | — | — |
| Dengue | — | — | — |
| Diabetes Mellitus | 1 | — | 1 |
| Diabetes Insipidus | 2 | 2 | 2 |
| Diphtheria | — | — | — |
| Dysentery | 85 | 4 | 85 |
| Enteric Fever | 89 | 32 | 89 |
| Erysipelas | 6 | — | 6 |
| Febricula | 1 | — | 1 |
| Filariasis | — | — | — |
| Gonorrhœa | 180 | — | 180 |
| Gout | — | — | — |
| Hydrophobia | — | — | — |
| Influenza | 18 | — | 18 |
| Kala-azar | — | — | — |
| Leprosy | 1 | — | 1 |
| (*a*) Nodular | — | — | — |
| (*b*) Anæsthetic | — | — | — |
| (*c*) Mixed | — | — | — |
| Malarial Fever— | — | — | — |
| (*a*) Intermittent | 6614 | 25 | 6614 |
| Quotidian | — | — | — |
| Tertian | — | — | — |
| Quartan | — | — | — |
| Irregular | — | — | — |
| Type undiagnosed | — | — | — |
| (*b*) Remittent | 813 | 33 | 813 |
| (*c*) Pernicious | 28 | 19 | 28 |
| (*d*) Malarial Cachexia | 1 | — | 1 |
| Malta Fever | — | — | — |
| Measles | 38 | — | 38 |
| Mumps | 4 | — | 4 |
| New Growths— | — | — | — |
| Non-malignant | 54 | 1 | 54 |
| Malignant | 54 | 3 | 54 |
| Old Age | — | — | — |
| Other Diseases | 34 | 2 | 34 |
| Pellagra | — | — | — |
| Plague | — | — | — |
| Pyæmia | 3 | 2 | 3 |
| Rachitis | — | — | — |
| Rheumatic Fever | 6 | — | 6 |
| Rheumatism | 691 | — | 691 |
| Rheumatoid Arthritis | — | — | — |
| Scarlet Fever | — | — | — |
| Scurvy | — | — | — |
| Septicæmia | 7 | 4 | 7 |
| Sleeping Sickness | — | — | — |
| Sloughing Phagedæna | — | — | — |
| Small-pox | — | — | — |
| Syphilis | — | — | — |
| (*a*) Primary | 331 | 6 | 331 |
| (*b*) Secondary | 83 | 2 | 83 |
| (*c*) Tertiary | 28 | — | 28 |
| (*d*) Congenital | 25 | — | 25 |
| Tetanus | 11 | 7 | 11 |
| Trypanosoma Fever | — | — | — |
| Tubercle— | 43 | 7 | 43 |
| (*a*) Phthisis Pulmonalis | — | — | — |
| (*b*) Tuberculosis of Glands | — | — | — |
| (*c*) Lupus | — | — | — |
| (*d*) Tabes Mesenterica | — | — | — |
| (*e*) Tuberculous Disease of Bones | — | — | — |
| Other Tubercular Diseases | — | — | — |
| Varicella | — | — | — |
| Whooping Cough | — | — | — |
| Yaws | 373 | — | 373 |
| Yellow Fever | — | — | — |

## LOCAL DISEASES.

| | Admissions | Deaths | Total Cases Treated |
|---|---|---|---|
| Diseases of the— | | | |
| Cellular Tissue | 420 | 3 | 420 |
| Circulatory System— | 135 | 16 | 135 |
| (*a*) Valvular Disease of Heart | — | — | — |
| (*b*) Other Diseases | — | — | — |
| Digestive System— | 1326 | 52 | 1326 |
| (*a*) Diarrhœa | — | — | — |
| (*b*) Hill Diarrhœa | — | — | — |
| (*c*) Hepatitis | — | — | — |
| Congestion of Liver | — | — | — |
| (*d*) Abscess of Liver | — | — | — |
| (*e*) Tropical Liver | — | — | — |
| (*f*) Jaundice, Catarrhal | — | — | — |
| (*g*) Cirrhosis of Liver | — | — | — |
| (*h*) Acute Yellow Atrophy | — | — | — |
| (*i*) Sprue | — | — | — |
| (*j*) Other Diseases | — | — | — |
| Ear | 71 | — | 71 |
| Eye | 180 | — | 180 |
| Generative System— | — | — | — |
| Male Organs | 263 | 7 | 263 |
| Female Organs | 212 | 4 | 212 |
| Lymphatic System | 194 | — | 194 |
| Mental Diseases | 10 | 2 | 10 |
| Nervous System | 258 | 19 | 258 |
| Nose | 9 | — | 9 |
| Organs of Locomotion | 255 | 3 | 255 |
| Respiratory System | 522 | 50 | 522 |
| Skin— | 2740 | 5 | 2740 |
| (*a*) Scabies | — | — | — |
| (*b*) Ringworm | — | — | — |
| (*c*) Tinea Imbricata | — | — | — |
| (*d*) Favus | — | — | — |
| (*e*) Eczema | — | — | — |
| (*f*) Other Diseases | — | — | — |
| Urinary System | 263 | 27 | 263 |
| Injuries, General, Local— | 1447 | 27 | 1447 |
| (*a*) Siriasis (Heatstroke) | — | — | — |
| (*b*) Sunstroke (Heat Prostration) | — | — | — |
| (*c*) Other Injuries | 974 | 7 | 974 |
| Parasites— | — | — | — |
| Ascaris lumbricoides | — | — | — |
| Oxyuris vermicularis | — | — | — |
| Dochmius duodenalis, or Ankylostoma duodenale | 152 | — | 152 |
| Filaria medinensis (Guinea-worm) | — | — | — |
| Tapeworm | — | — | — |
| Poisons— | 2 | — | 2 |
| Snake-bites | — | — | — |
| Corrosive Acids | — | — | — |
| Metallic Poisons | — | — | — |
| Vegetable Alkaloids | — | — | — |
| Nature Unknown | — | — | — |
| Other Poisons | — | — | — |
| *Surgical Operations*— | 1872 | 28 | 1872 |
| Amputations, Major ) | — | — | — |
| ,, Minor ) | | | |
| Other Operations | — | — | — |
| Eye | — | — | — |
| (*a*) Cataract | — | — | — |
| (*b*) Iridectomy | — | — | — |
| (*c*) Other Eye Operations | — | — | — |

times difficult to distinguish nurse from inmate. The nurses, both male and female, are underpaid and inefficient.

The matron goes round the female wards with me and discharges her duties as well as the conditions of the institution admit.

I am accompanied round the male wards by a male nurse, who for want of training is not competent. I think this should form a part of the duties of the master.

The food supplied to the inmates is poor in quality and the milk diet insufficient. Enough scope is not given to me to order extra nourishment in special cases. There is too much salt fish and not enough meat. The diet scale needs complete revision.

There is an increasing number of women who come to the institution for childbirth. Some of these are sent by the Jubilee Hospital. There are no special or suitable arrangements for these cases.

C. R. EDWARDS, D.M.O.

Hagley Gap, P.O., April 24, 1909.

I believe that the past year has been less "unhealthy" than the year or two preceding. The "seasons" have been more regular and favourable.

There has been the usual increase of malaria and diseases of the respiratory organs during and after the June and October rains, and there appears to be a connection between the "dry-weather" and gastro-intestinal disorders, in hand-fed infants especially (and here I would beg leave to mention the definitely increasing tendency of the people to buy "shredded oats" and other imported foods for feeding even infants of a few weeks old, to the neglect of normal breast-feeding). But, particularly in the present agricultural and general depression, the number of people in country districts who "come to doctor" in any given season is in more direct ratio to the amount of money in circulation than to the actual amount of acute disease, and this renders general conclusions liable to fallacy.

HARRY G. JOHNSTON, D.M.O.
St. David's.

Gordon Town, April 28, 1909.

During the financial year under review, viz., April 1, 1908, to March 31, 1909, I have to report that the greater part of the year was exceptionally dry, occasionally slight showers; afterwards appeared some cases of dysentery of a mild type: ascaris and typhoid fever; the latter caused two deaths, the disease had advanced before treatment could be adopted. Death due to heart failure.

The construction of the main road to Mavis Bank brought down enormous quantities of mud and sand helping to pollute the Hope River. Another factor is the latrines being in juxtaposition to the river, percolation must ensue more or less and is a menace to those drinking the water unless it is first sterilized.

The sanitary condition of the chief village has improved considerably, owing to the Parochial Board having adopted the system of sweeping the main road through "Industry" and "Gordon Town" and having the rubbish removed to a deposit ground.

Towards the latter part of the year the above diseases were noticed particularly after rain.

Several cases of typhoid fever came under observation; from inquiries made to locate the foci, I find it clearly evident that the cause is to be found in the numerous springs on the hillside.

JOHN J. ROGERS. D.M.O.

P. . River, May 4, 1909.

During the past year there has been no severe outbreak of sickness of any kind. Of course after the October rains there were several cases of malarial fever, but I came across very few of a severe type, and during the year I only saw two cases of enteric.

Manchioneal is the chief town in my district and from the swamps around it one would think it a very unhealthy place, but judging from the number of cases I treat there, it is very healthy. Possibly the strong sea breeze counteracts the effects of the swamps, or, what is more likely, the local druggists and bush doctors see most of the cases of serious illness.

The mortality was greater in the fall of the year. There had been the usual number of cases of gonorrhœa and syphilis. Yaws had disappeared for the present. The population is fairly well protected from smallpox.

F. R. EVANS, D.M.O.

Morant Bay, April 27, 1909.

I have to report that there has been nothing specially worthy of note in the health history of the district during the year ending March 31, 1909. Morant Bay is in a fairly good sanitary condition. The system of cement drains has been undergoing extensions and repair. Some effort was made to open up the town to light and air in connection with the alarm of plague in Venezuela and an attempt made, not very successfully, to deal with the rat problem.

There has been a fair amount of rain although not so much as the planters need.

Health conditions do not appear to have been markedly affected thereby.

The treatment of Yaws has been energetically carried on with very beneficial results.

The infant population is well protected by vaccination against small-pox. There is practically no re-vaccination, although here and there it is sought by persons proceeding to Central or South America.

T. M. BARTLETT, D.M.O.

**Colonial Medical Reports.—No. 6.—Jamaica** (*continued*).

Port Antonio, June, 1909.

The rainfall for the year amounted to 140·63 in., half the fall having occurred during the December quarter. Taking the deaths registered as an index of the health of the District during the year, it cannot, in spite of the heavy rainful, be considered an unhealthy one, and is a decided improvement on the preceding. The rainfall and deaths registered have been as follows during the past four years:—

| Year | Rainfall: Inches | Deaths registered |
|---|---|---|
| 1905-6 .. .. .. | 180·19 .. | 257 |
| 1906-7 .. .. .. | 116·04 .. | 357 |
| 1907-8 .. .. .. | 122·22 .. | 418 |
| 1908-9 .. .. .. | 140·63 .. | 352 |

The smallest rainfall was during the September quarter. From about August 1 there was a marked increase in the admissions to hospital, which numbered nearly 100 more than during July, and in September the admissions numbered 435, nearly double the rate for the June quarter. The increased rate was due to the large number of patients suffering from malarial fever who were admitted.

Although malaria was responsible for a great deal of sickness, the type of fever was usually mild in character; only three deaths occurred out of some sixteen hundred cases treated in the hospital. Malignant parasites were found in a few of the cases. It is of interest in this connection to note the very marked difference that the introduction of more exact methods of diagnosis has made. A case of fever accompanied with black vomit, jaundice and albuminous urine, before blood examinations were in vogue, would unquestionably have been called a case of yellow fever, and all sorts of precautions would have been taken, the trade of the place would no doubt have been seriously interfered with, and fear and consternation would have been depicted on every one's face. I had such a case, a blood examination was made early in the illness, when malignant malarial parasites were found, thus putting the matter of diagnosis beyond all question of doubt.

The subject of yaws should be taken up more vigorously; it is lamentable to think of the amount of suffering that it entails, and in some cases the hideous deformity that results from this easily preventable disease. The present law is barren of results, it needs amendment in the direction of compelling patients to submit to treatment. I saw over 200 cases in different parts of the district, probably a quarter of the total number. The people in the majority of instances sent for medicine, some few, however, did not take the trouble to do so, and only a few have continued to take it.

The vomiting sickness that one hears so much about in other parts of the island seems to be unknown in this parish, or at least in this portion of it.

The presence of plague in one of the neighbouring islands was the means of directing attention to the need for precautions in Jamaica. With this end in view some 600 rats were inoculated with Mexican rat virus during the summer months. The general opinion was that there was a sensible decrease in the number of rats, where they (the inoculated rats) were turned loose. It would appear desirable to make a constant effort to get rid of this pest; in some countries this is now being done. In England it is estimated that each rat consumed a farthing's worth of food per day, in Canada the estimated daily loss is $30,000, taking the same calculation the loss when applied to Jamaica amounts to about £280,000 per year, surely an amount well worth taking steps to save.

Some twenty-two cases of enteric fever were notified; with the exception of two or three imported cases they all occurred in persons living in the district. The contamination of the food by flies was the most likely source of infection.

Efforts have been made to keep up the work of vaccination, the people of the district being fairly well protected. The most difficult persons to deal with are those of the better class, who apparently think the enactments on the subject of vaccination were not intended for them, and simply ignore the requirements of the law.

Reference was made in my report last year to the dog nuisance. It is estimated that each tourist spends on an average about £5 outside the hotel; surely it is desirable to encourage them to come, and having come, to encourage them to remain. Dozens of tourists are compelled to leave in consequence of the barking dogs in the neighbourhood of the hotel. The suppression of the dog nuisance ought to be taken up; it will have to be some day.

C. A. Moseley, D.M.O.

Buff Bay, May 15, 1909.

During the first part of the period under review the health of the district was fairly good, but during the latter months of the year (from November) and the early part of this year to the end of February there have been quite a number of cases of the dysenteric type of malaria fever, several cases being treated in hospital and quite a number in private practice. There were no deaths. There were also quite a number of the ordinary remittent and intermittent type.

There has been no unusual mortality or meteorological conditions during the period under review.

The sanitary conditions of the town have been considerably improved during the last two years by the construction of open concrete drains. These drains have been extended another three chains during the last year, but should be extended another twelve to the west and seven to the east; this I understand is to be done during the present financial year.

The streets are kept fairly clean; they are swept three days in the week and the rubbish carted to dumping ground; the undergrowth is kept low. The great drawback to the sanitary conditions of this town is the absence of a water supply, there being none except at the public buildings. A water supply in the town is a necessity.

The children of this district are well protected from small-pox; the same cannot be said of the adult population, who refuse to have themselves vaccinated.

H. J. George.

Port Maria, May 25, 1909.

The prevailing disease is malarial fever. During the past year 496 cases of malarial fever have been treated in the Port Maria Hospital and a proportionately large number in outdoor and private practice.

I find the largest number occurred in December, and the next largest in February, whilst the smallest number was in April. I think the rainfall, which was heavy at the end of the year, is responsible for the large numbers in December and January.

The sanitary condition of Port Maria is far from being what it might be with more attention. The closet system in the town is universally bad.

Yaws and enteric fever were very prevalent during the year.

The condition of the people in respect of protection from small-pox is very unsatisfactory. Only about two-thirds of the children have been vaccinated and not one-tenth of the grown-up people re-vaccinated.

C. H. FARQUHARSON, D.M.O.

Richmond, P O., April 27, 1909.

In this part of the island the general health of the community has been good. We have been free from epidemics of any sort, and typhoid fever has again been completely absent so far as I know. At the fall of the year there was a good deal of malarial fever, but not so virulent in type as last year; and there were also quite a number of cases of pneumonia (acute lobar), a disease to which the peasantry readily succumb. Scabies was, I am glad to say, much less noticeable than in the previous twelve months.

The weather conditions during the year were generally favourable, with no very heavy rains and yet no drought.

The condition of the Richmond and Highgate villages in regard to sanitation is difficult to describe when one realizes that there is no water supply, no efficient supervision of the disposal of rubbish and refuse, and no latrine worthy of the name. It is a matter of the greatest importance that a suitable water supply shall be obtained and installed in these rapidly rising centres.

The population is fairly well protected from small-pox, 804 children having been successfully vaccinated during the year under review.

The Law providing for the notification of "Yaws" is doing some good, but some of the district constables are not very diligent in keeping up the regular supply of medicines, especially as they are usually paid shortly after the visit of the D.M.O., and get no further remuneration no matter how long the cases may have to be treated.

P. O. MALABRE, D.M.O.

St. Ann's Bay, May 14, 1909.

The inhabitants of the town of St. Ann's Bay have been remarkably free from fever and other diseases. Since the marshy land to the north of the main street of St. Ann's Bay has been filled in and the concrete drains have been laid, and the drainage generally improved, it is remarkable what a beneficial effect it has had on the number of cases of malarial fever in the town.

During the months of June and July there was a severe outbreak of remittent fever in what is known as the Bamboo District of St. Ann, and which comprises Bamboo with the surrounding districts of Clay Ground, Little Kent, and Hazlewood. I visited the districts on several occasions and saw sixty-three cases. There were eight deaths.

The disease was malignant malaria, and had a strong resemblance to enteric, and was accompanied with diarrhœa, extreme prostration and slight bronchitis, with very slight enlargement of the spleen.

In the months of October and November there was a severe outbreak of remittent fever at Ocho Rios, but of a different type to that in the Bamboo district. The features of this outbreak were high temperature with a very large spleen, enlarged liver, and profound anæmia. There were several deaths, but they only occurred in those who either would not or could not undergo treatment.

There has been no unusual mortality during the period under review.

The seasons were not remarkable for either mildness or severity.

The population is well protected against small-pox.

H. JOSLEN, D.M.O.

Alexandria, P.O., April 27, 1909.

During the months of August, September and October of last year, I reported several cases of enteric fever, sixteen in all, with three deaths. The disease was not localized to any particular part of my district.

I also, in the months of November, December, and January, treated an unusual number of cases of "Continued Fever" of a very severe type. In these cases the patients had rigors, but not marked, the hot stage frequently lasting for twenty-four hours, and then with only a slight remission of one or two degrees, the tendency for successive paroxysms to overlap being marked.

I had two very severe cases of a malignant type under treatment when Dr. Prout visited the district, and he very kindly offered to examine the blood for me. I prepared some films and sent them to him, and his report was that they showed a very considerable degree of "malignant malarial infection," and pronounced them cases of "malignant quotidian."

In this immediate district I treated nine cases with similar symptoms. One of these patients had a prolonged high temperature of 105·6 F., with only the occasional drop of one or two degrees, and almost constant delirium and diarrhœa. She died on the sixteenth day after the commencement of her illness.

In two centres particularly, I noticed that the houses were surrounded by rocks, of the honeycombed variety, holding water and serving as admirable mosquito breeding places

During the year under review I have seen and attended several cases of phthisis, especially in and around Brown's Town—the condition of many dwellings predispose in a large measure to the fostering of this malady.

I have mentioned the need for a better water supply in the Dry Harbour Mountains so often that it has become an old story. The long-felt want still exists at the present time, the lack of sufficient water even for ordinary purposes is severely felt.

Venereal diseases, with their complications, are prevalent, and there is no falling off in the number of cases.

*Re* protection from small-pox, the infant population are regularly vaccinated, but there is no re-vaccination done.

GEO. HARGREAVES, D.M.O.

Claremont, May 1, 1909.

The year has been a healthy one, few cases of acute serious illness having been seen or heard of by me. My district, being in the highlands, is an exceptionally healthy one.

Cases of malarial fever are few.

I have a number of cases of congenital syphilis, but few primary ones.

The sanitary condition of the towns in my district is satisfactory.

There was a good rainfall during the year.

A dry year in this district means a sickly one, as the water becomes low and muddy.

I have not up to the present been able to get the Board to put their markets into a proper sanitary state.

My district is well protected from smallpox.

V. FRENCH-MULLEN, D.M.O.

Falmouth, April, 1909.

During the colder months of December, 1908, January, February and March, 1909, there were several cases of illness amongst children, in which vomiting was present as a symptom, and there was also, during these months, an increased incidence in the number of cases of malarial fever, more particularly in the Salt Marsh and Martha Brae districts, and some of the cases were of a severe type—but there was complete immunity, as far as I am aware, from anything like epidemic prevalence of, or the occurrence of any of the zymotic and infectious diseases.

The mortality was highest (especially the infant mortality) during the colder months, about five times as many deaths occurring in January as in July.

The sanitary condition of the town of Falmouth is on the whole satisfactory, due in a great measure to certain natural advantages; more attention might be paid to the cleaning and weeding of the streets, and the filling up of a number of crab-holes, and some supervision of the milk, and control of other food supplies, might be, with considerable advantage, adopted.

Contrary to a somewhat general opinion, the town is comparatively exempt from malarial fever.

This exemption is remarkable, seeing that in the swamp and marsh land ("the rice fields"), situated immediately beyond the eastern limit of the town, the Anopheles and its larvæ abound.

The urgent necessity for a suitable place for the isolation of infectious diseases, or of cases suspected of being infectious, became apparent in October last, when a case was reported as "suspiciously resembling" pestis major (but which happily was not).

Vaccination was performed at the commencement and end of the period under review: the population is well protected (or appears to be) from small-pox. Re-vaccination might be considered.

FLORIZEL DE L. MYERS, D.M.O.

Ulster Spring, April 26, 1909.

The district, as a whole, is very healthy, and besides a couple of cases of enteric fever in the later part of last year, there have been no cases of very serious illness—the most prevalent complaints being affections of the stomach and woman's complaint.

I found great difficulty in getting the people to bring their children for vaccination, and on two occasions I had to bring the law to bear on a number of cases. Re-vaccination is never applied for, so the protection of small-pox, except in the children, is not secure.

FRANK H. COOKE, D.M.O.

Duncans District.

With the exception of the usual vomiting sickness which appeared as usual towards the end of the year in question, there was no marked increase of sickness or excessive mortality in the district during the year. Typhoid fever occurred sporadically in the district during the whole year, with the exception of the last quarter.

*Duncans.*—This town is on the coast road between St. Ann's Bay and Falmouth. It is, like all Jamaica towns, more or less insanitary, the outlying parts being overgrown with trees and bush of all sorts. There were heavy rains in October and November, causing an increase in malarial fever, but there was no mortality from this cause. The itch is still prevalent all over the district.

Yaws is also common, especially in Duan Vale—about fifty cases were seen and treated there.

Nearly every child above one year has been vaccinated.

F. A. G. PURCHAS, D.M.O.

Montego Bay, May 15, 1909.

During the year ending March 31, 1909, there has been no sickness of any serious or dangerous nature in the district brought to my notice. During October and early November there were a great many cases of malarial fever and influenza in and around Montego Bay. As regards the sanitation of the town of Montego Bay, I think there is still considerable room for improvement. Nearly all the streets and lanes have concrete water tables, but at the crossings where the drains are covered, *I understand the beds of the drains are not concreted, and the water, &c., when it*

*comes to these crossings flows over earth, which in most cases results in obnoxious smells, particularly during the dry seasons.*

The water supply has been good and continuous during the year; but I would again suggest the addition of filter-beds to the water plant.

*It has come to my knowledge during the year that there are a number of places in this town, particularly tenement dwellings, without any closet or latrine. The result is obvious.*

There is still a large sale of meat along the streets in open places, where the alert fly has every chance of getting a feed for nothing and every opportunity of leaving disease germs on what he has left to be sold to the unsuspecting buyer. This practice of selling meat at the roadside should be stopped, particularly as there is a large market in the centre of the town, big enough, I should think, for the size and population of Montego Bay.

During the latter part of the year after the rains started there was an outbreak of malarial fever all around, but not many deaths occurred.

During the month of January this year there occurred several cases of "vomiting sickness" in the districts of Mt. Carey, Roehampton, Mafuta and Montpelier. I was called to see several of the cases. Of the deaths that occurred from this disease, only one died after treatment. The others that were seen and treated recovered usually within forty-eight hours.

A large number of the people still have frivolous objections to their children being vaccinated, but I still vaccinate all those who can be got to bring their children. The lymph from the Lister Institute continues good and reliable.

G. P. CAMPBELL, D.M.O.

Lucea, P.O., May 1, 1909.

During my term of office of five months there has been no marked prevalence of any particular disease, with the exception of an increase of intestinal troubles, due no doubt to the effects of a prevailing drought when the water supply was somewhat poor.

As far as I can say the mortality rate has not been anything out of the ordinary.

The condition of the population in respect of protection from small-pox I should say is safe, from the fact that vaccination has been extensively performed from time to time.

ARNOLD T. CLARKE, Ag. D.M.O.

Sav-la-Mar, P.O., May 7, 1909.

As usual July and August were the most unhealthy months of the year when there were a good many cases of malaria under treatment, both in hospital and in private practice.

With regard to the condition of the town of Savanna-la-mar, I may say things remain just the same as they were last year. *If a little more attention were paid to drainage of the streets and lanes there would be fewer cases of malaria in the town.* One of the arguments used is that it is useless to drain the small puddles in the streets when there are too large lagoons one on either side of the town which are not drained. This is a mistake, for both these swamps or lagoons communicate with the sea and are salt or at least brackish.

The mortality rate has not been high during the past year, and no disease assumed an epidemic form in my district. The seasons have again been mild and the latter part of the year under review was very dry and cooler than usual.

I consider the condition of the population in my district with respect to protection from small-pox to be very much improved.

CHARLES E. HARVEY, D.M.O.

Lambs River District, April 26, 1909.

Generally speaking, the seasons as they occur in the Lambs River District do not present any very marked contrasts in the prevalence of disease. The district being entirely inland, has no town of any size; and while the sanitary conditions are far from perfect in the villages of Newmarket, Bethel Town, Seaford Town and Cambridge, the smallness of the population of these places, which hardly exceeds a hundred in any case, reduces the risks therefrom to a mimimum.

*The water supply of Bethel Town is from the York Spring, already found upon examination to be thoroughly polluted, and the typhoid bacillus present.* Cambridge is supplied by a spring which rises in a cave near by. The water of this spring has not been examined to my knowledge. Typhoid fever is not present in Cambridge. The water supply of Seaford Town is from "Clear Spring," so called, and from rivers and ponds. There are numerous cases of leprosy in Seaford Town, and framboesia is extremely common there. The water supply of Newmarket is solely from ponds, and not very inviting ones at that; yet the last-named place may be said to be the most salubrious of the four, and forms a "health resort" for many persons residing in Black River. These health-seekers, whose blood is charged with the malarial plasmodium, are bitten by the mosquitoes which are very common in Newmarket, and the malaria is thus transferred to the inhabitants of the place itself. Unless imported in this way malaria is extremely rare in Newmarket and that region; and when there have been no visitors there from malarial districts the cases of malaria among the inhabitants disappear altogether. Malaria is almost constant, however, in Cambridge, Seaford Town and Bethel Town. Cambridge is the least healthy of the four places.

During the wet months many cases of rheumatism occur in the Lambs River District. These come almost in waves, which would suggest the idea of an epidemic origin to the disease of which the clinical picture known to me as rheumatism is perhaps the symptom. Most of the diseases in the Lambs River District are, however, diseases of poverty and ignorance. The food supply of the people is almost entirely amylaceous; and though enormous in bulk does not adequately supply all the physiological requirements of a labouring people, many of whom though stuffed to repletion may yet be truthfully said to be underfed.

**Colonial Medical Reports.—No. 6.—Jamaica** *(continued)*.

Typhoid fever has been present in the York district and environs for the greater part of the year, the disease reaching a maximum in January and falling off rapidly since then. But cases are now occurring in the adjacent regions, Belvidere Mtn., Barney Side and Galloway. In this connection it may be pointed out that the people are extremely migratory, and the first man or woman one may meet has perhaps during the past seven days drunk water in turn in Montego Bay, Sav.-la-Mar and Falmouth, to all of which places he may have gone in the pursuit of his petty speculations. It would thus be difficult to say with certainty whence the infection has been derived in many isolated cases. In the late outbreak I was struck with the number of ambulatory cases; persistent low fever for two or three weeks resisting quinine, slight, but not great malaise, some looseness of the bowels, tenderness in region of appendix, &c. I treated one case of cystitis with no gonorrhœa history whatever; but which was accompanied by the characteristic symptoms of typhoid, though in so mild a form as to have quite escaped the notice of the patient himself. There have been probably a greater number of such cases here than I first suspected; and the immunity of many who have not had typhoid, according to their own story, may be explained here by such attacks, if such attacks can confer immunity, which by analogy, would seem probable.

Typhoid fever is most prevalent in Canada and the United States in the winter months, which coincides with the tourist season here; and as it is the custom of many practitioners there to recommend to patients during their convalescence after typhoid fever a sojourn in some warm country, it is highly probable that a large number of typhoid fever convalescents come every winter to Jamaica, and that they act as carriers of the bacillus of the disease; and may unconsciously introduce the disease here.

During the past six months I have made every effort to get the people to come out and have their children vaccinated; but they make every excuse to elude the provisions of the law. They are not systematic in their habits and chafe under the slightest restriction. I have thus only succeeded in vaccinating 700 children; but very few of these were under a year old. The people use every excuse to avoid coming out; and the district constables are somewhat averse to pushing the law in particular cases, as they do not wish to render themselves obnoxious to their neighbours.

I have reason to believe also that some of the schoolmasters connive quietly at this laxity of the people—judging by actual results afterwards—though their exhortations to their pupils may have been of the loudest when I was present.

E. H. B. STAFFORD, D.M.O.

Westmoreland (Little London), P.O., May 1, 1909.

I have to report that there was no epidemic of disease nor any unusual mortality in this district.

The general health has been very good as it usually is: were it not, in fact, for malaria (of a mild type) and yaws, both of which could be stamped out if the proper measures were adopted, there would hardly be anything to record during the year except the ailments which are usually designated "trivial."

Yaws, I am sorry to say, still flourishes. As one batch of those affected gets rid of it another is infected, and so on. As far as I can judge venereal disease has not been as prevalent during the past year as formerly.

F. A. SINCLAIR, D.M.O.

Malvern P.O., April 30, 1909.

The past year has not been attended with the existence of any epidemics of disease, and the seasons have been healthy.

There can hardly be said to be a town in this district, and such villages as exist may be said to have no sanitary condition whatever beyond what appertains to man in a savage condition.

The relative mortality I am unable to pronounce upon, as no data are available, but in my practice the deaths have no seasonal relative value.

Meteorological data are not available, the rainfall has been below the average, and in the low-lying parts of the district it would seem the health of the population has been above the average.

There have been no particular diseases calling for remark, influenza in varied form has recurred, but without most of the complications attending in northern climates.

Vaccination has been carried out in the whole district, and success is invariable.

J. A. L. CALDER.

Newport, April 28, 1909.

In the months of November and December, 1908, there was a sharp outbreak of enteric fever—not of a severe type—and which disappeared as suddenly as it appeared.

There was a regular epidemic of venereal diseases in the months of June, July and August, and the infection seemed to have been introduced by the labourers returned from the Isthmus of Panama, syphilis in its primary and secondary stages being very evident.

Syphilis is, I regret to inform you, a very common disease in southern Manchester, and more especially in certain districts.

Case of pulmonary phthisis are not infrequent, and as far as I can ascertain, the disease has been on the increase.

Yaws.—This disorder is prevalent in the districts of Harmons and Mount Oliphant. The disease has been treated with much success.

The rainfall has been unevenly distributed, but I can associate no disease with the meteorological conditions.

The juvenile members of the population have been vaccinated; but all efforts at re-vaccination have been almost entirely unsuccessful.

M. M. MEIKLE, D.M.O.

Balaclava P.O., April 27, 1909.

I have not come across any cases of the so-called "vomiting sickness" in this district during the past twelve months.

Malarial fevers have occurred during the year, and

at all times and seasons, but there has been no special outbreak of this disease at any time to call for special notice, and I may say that the remittent and intermittent cases about balance each other in number.

I have seen, I think, altogether six cases of tuberculosis. I have not seen any cases of cancer.

Venereal diseases still hold a prominent position in the daily work, and one feels bound to record that there does not seem to be any lessening in the amount of suffering caused by this, or rather these diseases. It is true that one is not often consulted for a primary sore, these are generally taken to the nearest dispenser for treatment, but the secondary and tertiary forms of syphilis are constantly in evidence.

Yaws has been treated in several parts of the district, and of those cases which have applied for treatment, nearly all are better, some of the later cases are still under treatment and are progressing favourably.

I cannot say that I have noticed any great difference with regard to the prevalence of sickness during the past year; it has been a more healthy year than the previous one, if anything, but one must not forget that the spending capacity of the people has not been quite equal to what it was a couple of years ago.

Then to look at the monthly health returns for this district a big falling off in the pauper list will be noted, and this to one who "does not know" may be taken for a brighter prospect in this line, but I can safely say, that this great diminution in pauper relief work is not because the poor do not need relief, but for the simple reason that the rules governing the granting and obtaining of sick relief are so hard, and I may say without any hesitation, so unkind, that the poor and feeble are unable to get the necessary help that they should have.

No outbreak of any special disease has occurred in this district during the time under review.

Vaccinations among the infants and young children have been thoroughly carried out; the younger members of the community are well protected from small-pox.

W. LOFTHOUSE, D.M.O.

Mandeville, May 8, 1909.

With the exception of the usual recurrence of enteric fever during the fall of the year (September to December inclusive) the health of the district has been very good, but every year there appears to be an increased number of cases of enteric.

Relative mortality in different seasons—

| | | | | | | |
|---|---|---|---|---|---|---|
| March quarter, | 1907 | .. | 140 | 1908 | .. | 105 |
| June | ,, | ,, .. | 107 | ,, | .. | 74 |
| Sept. | ,, | ,, .. | 124 | ,, | .. | 77 |
| Dec. | ,, | ,, .. | 88 | ,, | .. | 85 |
| | | | 459 | | | 341 |

showing a marked reduction in mortality during the past year, which is probably due to the fact that the rainfall was much less than usual.

Vaccination was carried out thoroughly in the district.

GEORGE COOKE, D.M.O.

Mile Gully Medical District.

Though there has been more than the usual amount of dry weather, the seasons have been on the whole neither very wet nor very dry, and they do not appear to have had any marked influence upon the mortality rate.

The sanitary conditions remain as already reported upon.

There has been the same number of cases, eighteen, of enteric fever, as in the preceding year.

Syphilis appears to be on the increase and it is remarkable that cases often follow one another in rapid succession from a particular locality, indicating a common source of infection.

Five hundred and twenty-eight successful vaccinations were performed.

E. V. HALLIDAY, D.M.O.

Christiana, Chapelton, April 28, 1909.

During the year no disease appeared in epidemic form, the usual infantile diseases being conspicuous by their absence.

The vomiting sickness appeared in November and lasted for a few weeks, claiming its usual toll of victims, but the outbreak was not so severe nor did it last so long as in previous years.

The district has been vaccinated regularly, but a number of parents are averse to this protective measure.

A. W. THOMSON.

Vere, June 6, 1909.

During the past year there was no epidemic disease among the peasantry. It was a particularly dry year and the great scarcity of work meant great suffering and privation among them, but the number of fever cases were very small comparatively. A large number of cases were admitted to the hospital (Creoles) in an emaciated and starving condition as well as being seriously ill, so bad were many cases that they practically came in to die, making an unusually high death-rate among the Creole patients. Most of them were peasants from the Manchester and St. Elizabeth parishes.

The seasons were so little marked that there was practically little or no difference in the mortality during any period of the year, as a severe drought prevailed practically the whole year.

As I wrote last year the adult population are not at all protected from small-pox, many old people never having been vaccinated at all.

HARRY G. TILLMAN.

May Pen P.O., May 7, 1909.

The rainfall has been, I believe, much below the average, and no prevalence of any disease that is usually ascribed to climatic influences has occurred. During the latter end of the year 1908, the ordinary bilious remittent type of fever was fairly prevalent, but no more so than in previous years, and always proved amenable to treatment. Ordinary cases of malarial origin occur from time to time.

During April—June four cases of typhoid fever occurred, two of which ended fatally. These cases came under my personal notice. A few cases of

pneumonia occurred during the latter part of the year; none ended fatally.

"Vomiting sickness" (so-called) has so far as I know not occurred: most of the cases reported to be of this nature are generally due to other causes.

Yaws is still prevalent in the mountain parts, but not to such an extent as heretofore. A large number have been cured by treatment, and the people are more willing now to take the necessary trouble to have their children attended to, as they receive medical aid without any cost; 167 new cases were seen during the year.

A few cases of chicken-pox have, I believe, been heard of during February and March, but they never come to the doctor for treatment. I have not heard of any cases of measles or whooping-cough.

The young population is well protected from small-pox; during the last four years about 4,200 people have been vaccinated: but my remarks as regards the adult population, made in previous yearly reports, still hold good. Until re-vaccination is made compulsory the adult population will always be more or less practically unprotected.

EDW. R. C. EARLE, D.M.O.

Spanish Town, May 19, 1909.

The general health of the community is fairly good. Influenza of a mild character was epidemic in June, 1908. Seven cases of enteric fever were reported, with one death. Malarial fevers were prevalent, especially on banana plantations.

Venereal diseases appear to be on the increase.

Infantile diseases as usual were prevalent.

I have again to report the *sanitary conditions of Spanish Town as far from being satisfactory.* Drainage is defective, unoccupied lands need cleaning and fencing.

The streets when metalled with broken stones require a *heavy roller to crush them,* so that the work of sanitation may easily be carried out.

The *Infectious Disease Hospital* is, from its close proximity to dwellings, &c., absolutely unsuited for the purpose for which it is intended. A new and modern style of hospital should be erected on lands where proper isolation can be carried on.

*The chief market of the town is kept in a filthy condition and reflects on the mismanagement of those concerned.*

The Poor House under the present management of the Resident Master and Matron is a model Institution and the inmates well cared for.

Vaccination has been carried out at the various out-stations in the district in the past year.

J. H. PECK, D.M.O.

Stony Hill P.O. May 14, 1909.

The general health of the district has been good. There has been an epidemic of chicken-pox of mild type; influenza has occurred, but to no great extent. Some cases of typhoid fever occurred in Shortwood College. There has been no further case in the last six months.

The condition of the water supply of Stony Hill remains as before. The Local Board of Health is taking action.

There has been no marked mortality in any season: and no very great severity of flood or drought in the district.

Beyond the epidemic mentioned above there are no special outbreaks to report.

Yaws exists, and is being treated with very fair success. Cases of ankylostomiasis occur in various parts.

The district was thoroughly vaccinated to December last. Vaccination is now going on. At the same time I would point out that until re-vaccination is made compulsory, the protection of the population from small-pox is only partial.

R. S. TURTON, D.M.O.

Old Harbour, April 24, 1909.

The general health of the district has been good.

The sanitary condition of the town of Old Harbour is satisfactory.

The mortality has not varied in the different seasons, and is very low.

The drought that has existed since the earthquake still continues. With the exception of occasional showers, there has only been one day on which rain has fallen.

A widely spread outbreak of yaws occurred in the mountainous parts of the districts, though places in the immediate neighbourhood of Old Harbour were almost free from the affection.

The population is adequately protected from small-pox.

F. O. SIMPSON, D.M.O.

Linstead, May 17, 1909.

There has been no unusual sickness or mortality. As usual, malarial fevers formed the chief bulk of the ailments treated, while there was also a fair proportion of enteric cases.

Again, I have to complain of the *insanitary condition of Linstead.* Stagnant pools of fetid water in the streets are still very much in evidence; and the vile odours that assail one's nostrils at night from these same pools, and the foul latrine-pits in the yards are most objectionable. Linstead will never be in a better sanitary condition until an extensive and proper system of drainage is effectively carried out, and more rigorous supervision of the latrines enforced, so that they may be more frequently cleaned and disinfected. In spite of a by-law prohibiting it, pigs roam through the town, and their offensive sties pollute the air.

Vaccination work was regularly carried out during the year.

L. M. CLARKE, D.M.O.

Public Hospital, Kingston, Jamaica,
June 18, 1909.

The total number of patients treated in hospital were 3,729, of this number 198 remained in hospital at the end of the year. There were 362 deaths during the year, as compared with 401 during the previous year. Of those who died 12 were of the number remaining from last year.

The daily average number of beds occupied was 188, as compared with 194 in the previous year.

The number of applicants for admission to hospital who were rejected for want of accommodation or for other reasons was 4,132. These applicants are either referred to the District Medical Officer or else to the Inspector of Poor, or are advised to return on another day and apply for admission.

The number of deaths occurring within twelve to seventy-two hours after admission was 112. These cases were admitted in a more or less moribund condition.

The majority of these cases were brought by their relatives or friends to hospital, on one hand to obtain a death certificate and on the other to save funeral expenses.

The death-rate was 9·7 per cent. I may remark that the death-rate is increased by the admission of incurables brought to hospital in a critical condition.

Of the medical cases treated the most noteworthy diseases were :—

(*a*) *Malarial Fever.*—The number of cases of malarial fever treated in hospital during the year was 694, as compared with 666 treated in the previous year. Of the 694 cases treated 21 cases terminated fatally.

The largest number of admissions was in December last when 137 cases were admitted.

(*b*) *Tubercular Diseases.*—Under the above heading 139 cases were treated, of this number 69 were cases of pulmonary phthisis and 22 cases proved fatal.

The remaining 70 were cases of tubercular disease of the bones, joints, glands, peritoneum, &c.

(*c*) *Enteric Fever.*—Under this heading there were 170 cases admitted; of this number 73 proved fatal.

A large number of these cases treated suffered from pneumonia, others were complicated with severe hæmorrhage. The high death-rate was no doubt due to the fact that a very large number of cases were admitted in a critical condition, indeed in some of the cases an autopsy had to be performed, as they died within a few hours of admission, and the examination revealed advanced ulceration, and in some cases actual perforation of the gut.

(*d*) *Colitis.*—Under this heading there were 93 admissions, of this number 14 proved fatal. Several of these cases were chronic and consequently very difficult to treat.

(*e*) *Pneumonia.*—There were 58 cases admitted under this heading, 12 cases ended fatally.

(*f*) *Venereal Diseases.*—The total number of cases treated under this heading was 309, as compared with 268 cases treated in the previous year.

Thirteen hundred operations were performed and there were 28 deaths.

There were 33 laparotomies performed with five deaths. Of the five deaths, three were admitted in a moribund condition suffering from intestinal obstruction. One case of perforated gut and one case of hysterectomy. Taken all round the results have been excellent.

The new operating room was completed and opened in the middle of May, and to this up-to-date room the excellent results are in no small measure due.

The number of casualties treated during the year was 6,432, as compared with 7,127 attended to in the previous year.

CHARLES W. M. CASTLE, M.R.C.S.,Eng.,
Senior Medical Officer.

VICTORIA JUBILEE LYING-IN HOSPITAL,
March 31, 1909.

The number of patients admitted during the year was 596, against 434 of the previous year. On account of this marked increase the available beds were almost constantly occupied throughout the year; a considerable number of applicants had to be refused admission : 400 of the patients were black, 188 coloured, three coolies and five white. They stated their ages as follows : 115 under 20 ; 405 between 20 and 29 ; 71, 30 and 39 ; 5, 40 and 49. 170 were married. 508 resided in Kingston ; 83 in St. Andrew ; five in more remote parishes. There were 10 deaths during the year. Five from puerperal convulsions and one each from Bright's disease, hæmorrhage, dysentery, septicæmia and peritonitis. Most of these cases were brought in in a hopeless condition.

The number of infants born was 568 ; 300 males and 268 females. There were 7 cases of twins and one double monster ; 49 infants were still-born.

M. GRABHAM.

LUNATIC ASYLUM.

There were in the Asylum on the last day of the preceding year 1,032 inmates, of whom 519 were men and 513 women. During the year 237 patients were admitted : 114 men and 123 women, the total number under treatment being, therefore, 1,269, of whom 633 were men and 636 were women. Compared with the preceding year, the admissions were fewer by 42, and the number under treatment fewer by 16. As pointed out in former reports a large proportion of the admissions were half-starved physical wrecks, 15 of them dying under one month's residence. There were 85 discharged recovered, six discharged relieved, three unimproved.

The number of deaths were 120, or 11·4 per cent. calculated on the average number under treatment, an improvement on last year when the percentage was 12·2. The number of deaths on the male division just doubled the number on the female division, which was doubtless due to the overcrowding here subsequent to the earthquake. The buildings are being rapidly restored and by the end of this year normal conditions will prevail.

In continuation of my note in last year's report on pellagra, a nervous disorder, due it is believed, to the consumption of damaged maize, the attempt made to eradicate the disease by the substitution of bread, sugar and fruit for cornmeal has proved but a partial success. There was an undoubted diminution of the number of cases in our wards, but as several new cases occurred long after the withdrawal of the cornmeal I am not satisfied the condition is entirely due to the consumption of damaged maize and propose restoring, though to a limited extent, the cornmeal rations.

D. J. WILLIAMS,
Medical Supt.

**Colonial Medical Reports.—No. 6.—Jamaica** (*continued*).

LEPERS' HOME.

Jamaica Leper Asylum, April 30, 1909.

The Public Works Department completed the reconstruction of the kitchen, which was greatly needed. The exterior of the female wards and the Infirmary were painted, and the interiors limewashed. General repairs were effected on various buildings, the floors, windows and fences being repaired. The Matron's bathroom was enlarged and a bath supplied. The concrete drain was extended.

*The Bacteriology of Leprosy.*—The bacillus of leprosy was first discovered by Hansen in 1871. Neisser in 1879 confirmed Hansen's observations, and although the germ fails to come under the postulates of Koch it is generally accepted as the specific cause of the disease.

Up to the present the cultivation of the bacillus in artificial media has failed. I propose to give a *résumé* of the most recent experiments in this direction.

Bordoni-Uffreduzzi claimed to have cultivated a microbe from the bone marrow which resembled the lepra bacillus, and the experiments were confirmed by Gianturco, but as the germs could not be obtained from other leprous organs, they cannot be accepted as being true lepra bacilli.

Campana and Ducrey cultivated an anaerobic bacillus from leprous material, but as this germ was decolourized by the staining method of Koch-Ehrlich it was clearly not Hansen's bacillus.

The most interesting microbes obtained from the blood and tissues of lepers are some diphtheroid bacilli that have been cultivated by Babes, Levy, Czaplewski, and Spronk. After Levy and Czaplewski had published their discoveries a prolonged discussion took place and eventually both authorities stated that they did not believe that the pseudo-diphtheritic bacillus had any relation to leprosy.

Spronk's bacillus was cultivated on specially prepared potatoes, and he claimed a stronger agglutinating power of leprous blood serum than from that of healthy persons, but Babes could not confirm his experiments.

Some of the latest researches have been conducted by Scholz and Klingmuller. They would apparently have had the most suitable cases for their experimental cultivations, which were carried on for over one and a half years. They not only used the ordinary media of the laboratory, but tried every conceivable preparation, and they report that their results were in every case negative. They confirm the finding of Babes that the agglutinations claimed by Spronk for the diphtheroid bacillus found in some cases was no stronger in leprous than in normal serum.

It is further interesting to note that in Russia, Germany, and England, a disease has been observed in rats which presents many of the characteristics of leprosy. Dean has fully described the affection in the *Journal of Hygiene*, vol. xcix.

The lesions of the skin are the same, and they contain a bacillus which stains in the same manner as the lepra bacillus, that is, it is acid-fast. Rats can be inoculated with the tissue juices of an infected animal, but no other species of animal is affected. The organism cannot be cultivated outside the body of the rat by any known means, but Dean has obtained a diphtheroid bacillus, most interesting in relation to the discoveries of Babes, Spronk and others, with reference to leprosy.

As these pseudo-diphtheria bacilli are widely distributed, and have been obtained from the mouth, nose, skin and blood of diseased persons, as well as from some healthy subjects, I cannot believe that they have any relation to leprotic disease.

I have recently at my own expense fully equipped a bacteriological laboratory, and I hope to carry out some original research on this interestingand important subject.

*The Treatment of Leprosy.*—Since my return to Jamaica I have been treating leprosy with nastine, after the method described by Deyke Pasha.

Deyke Pasha and Reschad Bey of Constantinople have prepared from cultures of the leprosy bacillus on milk a pure fatty substance which they regard as the glycerine ester of a highly fatty acid, and to which they have given the name Nastine. To this is added benzoyl chloride, the chloride of the simplest aromatic acid, namely, benzoic acid. This substance was first obtained by Liebig and Wohler by the action of chlorine on benzaldehyde. The preparation obtained by the addition of this acid haloid is called Nastine B, and standard solutions are made by dilutions with sterile olive oil, which are injected subcutaneously. The authors claim that nastine is the fatty substance in the bacillus of leprosy which gives the organism its high power of resistance, and by the injection of the bacterial fat active immunity is produced against the same substance in the bacilli.

Kempner and Schepilewsky have demonstrated that pure neutral olive oil has the power of promoting immunity to toxines, notably with the *Bacillus botulinus* of Van Ermengem. This theory is diametrically opposed to that by which immunity is produced by Koch's tuberculin in tuberculosis, a closely allied affection.

Four children were selected, three being tubercular and one anæsthetic. They were in good health except the anæsthetic lad who is somewhat anæmic and ill-nourished. The results are practically negative. The disease is no more retarded or arrested than would be demonstrated by any form of tonic treatment, and in my opinion is not as effective as the treatment by mercurial injections or chaulmoogra oil.

The treatment lasted four and a half months, covering a period of clinical observation sufficiently long to note some improvement if present. The authors, however, conclude one of their pamphlets with the following: "The less one expects rapid and miraculous results and the more one is able to control one's own and the patient's impatience, the better results will be obtained."

W. D. NEISH, M.D.,
Medical Attendant.

## Colonial Medical Reports.—No. 7.—Shanghai.

# MEDICAL REPORT FOR THE YEAR 1909.

**By ARTHUR STANLEY, M.D., B.S.Lond., D.P.H.,**

*Health Officer.*

THE condition of the public health during the past year may be considered satisfactory. Though threatened by plague, the crucial period was passed without the occurrence of human cases. The reason for this immunity is not obvious. Shanghai and the Yangtsze ports have by some been considered to possess a special immunity from plague, but there would appear to be little to support this idea. Since the increase in communication between ports occasioned by steam shipping, plague has appeared in many parts of the world under almost every variety of condition and circumstance. The occurrence of plague in Hankow and Wuchang tends to show that no special immunity exists, and to think that it does is calculated to give a false idea of security. The absence of human cases of plague, therefore, may be attributed to the difficulty with which plague naturally spreads and to the sanitary measures taken against it. It is known that plague among rats may exist for some years before it breaks out among human beings, so that measures against rats are called for as long as plague-infected rats can be found. There is no finality about measures of rat destruction, but by rat-proofing houses plague may be permanently built out. This and the keeping of cats are probably the two most permanently useful measures against plague in Shanghai. The question of rat-proofing was referred to a committee of property owners, but, as the initial expenditure of effectual rat-proofing was seen to be large, in the absence of any obvious immediate danger from plague the matter was not discussed in a way conducive to the adoption of radical measures. In the matter of rat-proofing houses nothing can safely be conceded to individual parsimony. Steel and concrete are the ideal materials for houses in any town threatened by plague, and, in considering the cost, the immunity also from fire and earthquake may also be considered.

The prevention of any disease necessarily depends upon a knowledge of its cause. It is therefore of primary importance to maintain the municipal laboratory in a condition of maximum efficiency, as it is in the laboratory that the cause of disease is mainly worked out; the laboratory is, as it were, the brain of the public health organism. Routine work has increased out of all proportion to the size of the health office building, so that there is now little room for research work nor time for the present staff to engage in it. An extension of the laboratory is desirable, and an assistant engaged in research work only would be a valuable addition to the staff. It would appear to be best to have research workers nominated from the home schools for a limited period from time to time to specialize in such subjects as would prove of most use, direct or indirect, to the health of the community. The field of pathological research in China is practically unworked. There could be no greater primary benefit to the health of the community than that which would result from continuing to make the Shanghai Municipal Laboratory a place for research work. No subject connected with medicine has been so much developed of recent years as that of parasitology in its relation to disease. These are great days of preventive medicine, and laboratory studies have produced a power against disease never before exercised either by sanitarian or practitioner.

The rat has not been the only animal against which action has been taken for the benefit of the health of the Settlement. The mosquito has received an augmented degree of attention; as also has the domestic fly, which is an obvious danger as a carrier of infection. Regarding mosquitoes an extended plan of campaign was carried out. In addition to the elimination of stagnant water, which has been going on for several years, direct measures were taken against the propagation of mosquito larvæ on private property by house-to-house visitation of a special mosquito extermination staff. An amelioration of the mosquito nuisance was effected at a cost of about Tls. 6,000, and should the continuance of the work be sanctioned, improvement will undoubtedly take place as a result of the fuller understanding of what is required between the sanitary staff and the community. The goal to be striven after is the total extermination of mosquitoes in the area operated; but unless an intelligent effort be made by both the foreign and native community to prevent the development of mosquitoes on their own premises, an army of foreign inspectors and coolies, armed with absolutely compulsory power, would be necessary, but with active co-operation of both foreign and native householders, the work would become comparatively easy and success would be certainly attained by quite a small staff. The capacity of the house-fly to communicate certain diseases has been proved. Disease-producing organisms, especially those of typhoid fever, dysentery, and cholera, are found on its body, and are thus conveyed to food. Filth and human food are equally sought by this obscene insect. It is therefore a matter of importance to keep flies away from food between the time that it leaves the fire and the time that it reaches the mouth. As the extermination of mosquitoes is attained by measures directed, not against the winged insect but against its larval stage in the water, so in the

case of flies is it necessary to destroy the place where the larvæ of the fly (maggot) develop, such as filth and refuse. It is therefore advisable to keep the part of the house where food is found scrupulously clean, to keep the yard free from dirt and to place refuse in covered receptacles. The presence of rats, cockroaches, and flies about a house is an indication of dirt or matter in the wrong place.

With an area under sanitary control of over eight square miles, divided into four sanitary districts, each of which is again divided for sanitary purposes into sub-districts, sections and blocks, there is need of local centres for practical sanitary work. Perhaps the reason for these health stations which will be most apparent is the need for some place where vision of some sort of sub-district depôt, and for this purpose a native house was rented which served as a store for sanitary apparatus and materials, a place for collecting trapped rats and for the cleaning and baiting of traps, for the distribution of sanitary notices and for vaccination. The sooner provision is made for such health stations the more efficiently will sanitary work be carried out.

The collection and disposal of house refuse is not by any means a simple matter. There is no doubt that the best mode of disposal is its use for agricultural purposes, and with this object "country boats" have been encouraged to take away house refuse direct from the shoots. More than half of the total quantity is so disposed of, but the demand is variable; practically the whole amount is taken

METEOROLOGY OF SHANGHAI.

| | January | February | March | April | May | June | July | August | September | October | November | December | Year 1909 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Barometer* | | | | | | | | | | | | | |
| Mean inches ... ... | 30.281 | 30.250 | 30.196 | 29.966 | 29.907 | 29.730 | 29.760 | 29.667 | 29.836 | 30·088 | 30.220 | 30.322 | 30.019 |
| Departure from average | −0.042 | −0.033 | +0.025 | −0.038 | +0.036 | −0.008 | +0.079 | −0.062 | −0.074 | −0.017 | −0.025 | +0.016 | −0.012 |
| *Temperature* | | | | | | | | | | | | | |
| Mean degree ... ... | 39.07 | 39.97 | 44.38 | 57.16 | 66.15 | 71.24 | 80.92 | 81.25 | 76.55 | 64.89 | 52.61 | 41.79 | 59.665 |
| Departure from average | +1.27 | +0.88 | −1.67 | +1.00 | +0.58 | −2.09 | +0.59 | +1.05 | +3.73 | +1.55 | +0.72 | −0.34 | +0.61 |
| *Daily range of temperature* | | | | | | | | | | | | | |
| Mean degree ... ... | 10.42 | 13.36 | 41.81 | 18.47 | 21.91 | 13.97 | 13.91 | 19.44 | 14.81 | 14.56 | 18.70 | 17.98 | 16.029 |
| Departure from average | −2.95 | −0.16 | −0.20 | +1.78 | +4.58 | −1.29 | −0.90 | +4.12 | −0.80 | −2.34 | +1.71 | +1.91 | +0.455 |
| *Degree of humidity* | | | | | | | | | | | | | |
| Mean (saturation—100) | 81.0 | 77.3 | 79.6 | 76.5 | 72.2 | 88.9 | 82.0 | 80.6 | 85.6 | 81.8 | 78.3 | 77.0 | 80.06 |
| Departure from average | +1.5 | −1.5 | +0.2 | −3.6 | −7.6 | +5.1 | −2.2 | −3.8 | +2.6 | +2.0 | +0.8 | +1.0 | −0.458 |
| *Rainfall* | | | | | | | | | | | | | |
| Amount in inches .. | 2.69 | 1.85 | 5.70 | 1.75 | 0.89 | 12.64 | 3.48 | 4.26 | 7.26 | 6.29 | 2.05 | 1.92 | 50.78 |
| Departure from average | +0.53 | −0.47 | +2.33 | −2.05 | −2.75 | +6.20 | −2.13 | −1.62 | +2.57 | +2.93 | +0.30 | +0.73 | +6.57 |

The above figures have been kindly furnished for this report by Father Froc, Director of the Siccawei Observatory.

ordure buckets and refuse barrows may be stored when not in use, instead of being left about the streets and alleys, as is necessarily the case at present. It has been clearly demonstrated that proper sanitary work in Shanghai necessitates the closest foreign supervision. Each foreign assistant inspector should have a greeting acquaintance with most of the Chinese in his sub-district, and in this way, by getting closely into touch with their habits and mode of thought and language, considerable progress in sanitation can be made, and for this reason, among others, there should be quarters for the assistant inspector as a part of the health station. The carrying out of the special plague prevention work necessitated the immediate pro-

away during the months of March, April and May, while but a quarter of the total quantity collected during July, August, September, and October is thus removed. The remainder is either barged away and dumped at the depôt up the Soochow Creek or is used for raising low ground within the Settlement. Of these modes of disposal, the order of sanitary merit is considered to be (1) disposal for agricultural purposes, (2) disposal for purposes of raising low ground, (3) dumping at depôt. Four years ago the whole of the house refuse was dumped at depôts, a considerable proportion going into the creek; during the present year a third was dumped at the depôt, a fifth was used for raising low land, and nearly half of the quantity collected was

taken away by the country boats for agricultural purposes. As a natural sequence a permanent depôt is now recommended as near the centre of the Settlement as possible to facilitate transport and supervision, to facilitate distribution for raising purposes, to provide a place where the refuse can lie until it becomes naturally purified, which has been found to be the case between one and two years, and finally, when all the low land near the Settlement is raised, to provide a site for the erection of refuse incinerators.

### Vital Statistics.

*The Foreign Population* of the Settlement north of the Yangkingpang, including the outside roads and Pootung, at the last census taken on October 14, 1905, was 11,497, and consisted of 5,728 men, 3,270 women, and 2,499 children. The foreign shipping population, which numbered 2,510, was not included. The foreign population for the middle of 1909 is calculated at 15,000. The census of the foreign population taken at each quinquennial period since 1870 shows the following expansion: 1,666, 1,673, 2,197, 3,673, 3,821, 4,684, 6,774, 11,497.

*The Native Population* on October 14, 1905, was 452,716, and consisted of 212,517 men, 118,432 women, and 121,767 children. The Chinese population for the middle of 1909 is calculated at 550,000. The census of the Chinese population taken at each quinquennial period since 1870 shows roughly the following expansion: 75,000, 96,000, 108,000, 126,000, 168,000, 241,000, 345,000, and 452,000.

*Deaths among the Resident Foreign Population.*—During the year 1909 the total corrected number of deaths registered among foreigners, including non-Chinese Asiatics, was 324; of this number 251 occurred among the resident population.

Six months spent continuously in Shanghai is taken to constitute residence as in former reports. As the non-resident population is a variable and indeterminate factor, the deaths in this category are eliminated in the calculation of the death-rate. The death-rate per thousand per annum, therefore, calculated from 251 deaths occurring among the resident foreign population of 15,000, is 16.7, as against 15.9 in 1908. The deaths of 102 children (persons under 15) have been registered, as against 72 last year; of the deaths among adults, 99 were men and 50 women; of children, 59 were boys and 43 girls. The mean age at death among the adult resident population was 40.3.

There have been no deaths from smallpox during the year.

The figures for typhoid fever are practically the same as the two previous years.

The reduction in the mortality from diphtheria during the last few years may be accounted for by the early and more general treatment by antitoxin, which is now produced in the Municipal Laboratory.

Scarlet fever, which killed so many in 1902, lingers among the community, though the number of deaths remains small both among foreigners and Chinese.

Tuberculosis heads the list of fatal diseases both among foreigners and natives, and calls for a measure reducing the overcrowding which is so apparent in the Settlement.

Five deaths were caused by alcohol.

Lobar pneumonia, which seven years ago assumed almost epidemic proportions, caused three deaths.

Dysentery showed a marked increase as a cause of death, 21 fatal cases being registered, as against five last year.

Beri-beri is now a prominent cause of death among foreigners on account of the increased Japanese population.

Plague-infected rats were found throughout the year, but there have been no human cases.

There were five suicides among foreign residents during the year.

Among the non-resident population the chief causes of death were tuberculosis, dysentery, acute diarrhœa, typhoid fever, and drowning.

*Deaths among the Native Population.*—8,329 deaths among the Chinese have been reported, compared with 5,689, 6,443, and 8,156 in the three previous years.

The death-rate per thousand per annum is 15.1. There were 19 deaths from smallpox and 828 from tuberculosis, as against 143 and 938 respectively last year. Of the deaths, 4,929 were male and 3,400 female. The deaths of 2,778 children (persons under 15) have been registered; of these, 1,510 were boys and 1,268 girls.

### Infectious Disease.

In the absence of legal obligation to notify, an arrangement has been made between the Municipal Council and the qualified medical practitioners of Shanghai requiring notification of infectious disease for the facilitation of preventive measures, in consideration of the use of the resources of the public health laboratory for the purposes of pathological diagnosis and the payment of a fee of one tael for each case. The notifiable diseases are smallpox, cholera, typhoid fever, typhus fever, diphtheria, scarlet fever, tuberculosis, plague, anthrax, glanders, leprosy, and hydrophobia. Tls. 385 was paid for notification fees, as against Tls. 269 and 299 in the two previous years.

The system of notification, so far as it goes, has worked well, and the best thanks of the community are due to my colleagues in general practice for their co-operation. Chinese cases are seldom usefully notified at present, and it will probably be necessary to wait for the advent of the properly educated Chinese practitioner before this necessary preliminary to preventive work can be expected.

During the year 107 bills of health for ships and cargoes were issued, as against 98 in the previous year.

Weekly returns of infectious disease have been exchanged so as to get in touch with the sanitary condition of places in the Far East in communication with Shanghai.

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Isolation for cases of infectious disease among foreigners and Chinese is provided in the Isolation Hospital, Range Road, an account of the work of which institution will be found under the heading "Hospitals."

6,328 rooms were disinfected, as against 550 and 205 in the two preceding years; 89,346 articles have been disinfected by steam, compared with 23,500 and 34,882 in the two preceding years. 13,535 articles were disinfected by formalin, compared with 2,729 last year. The disinfection station adjoins the Isolation Hospital. Prior to disinfection each disinfector dons a sterile overall. The general method of disinfecting in a house after a case of infectious disease is, firstly, to remove to the station everything that can be disinfected by steam; then to spray and wash walls, floors, fittings and furniture with disinfecting solution (cyllin). Fragile and delicate ware, such as bonnets, furs, books and photographs, are disinfected by formalin. In many cases, such as after typhoid fever or diphtheria, disinfection of walls, &c., is not considered always necessary, the washing with disinfectant being then limited to articles that have been actually in contact with infected material. After disinfection painting or colour-washing of walls and ceiling is advised to be done by the occupier before the room is again occupied, without which no responsibility can be accepted by the Health Department.

The incidence of smallpox has been exceptionally small. One case only was notified among the foreign resident community. Among the Chinese there were 19 deaths from smallpox, as compared with 143 and 863 during the previous two years.

Smallpox is the typical preventable disease, and its presence or absence is an index of the hygienic education of a community. In Shanghai the Chinese are beginning to appreciate the benefits of vaccination as opposed to inoculation, which they have practised with little benefit for hundreds of years, and which is now illegal in almost all civilized countries.

Vaccination is done free for all Chinese and indigent foreigners applying at the health office. Vaccine is also supplied free to the Chinese hospitals in Shanghai. 3,244 vaccinations have been done at the health office during the year, as compared with 465, 380, 520, 1,418, and 4,649 in previous years.

There is no doubt that vaccination repeated until it no longer takes always prevents smallpox. The criterion of efficient vaccination is inability to be vaccinated. In Shanghai there exists so much smallpox infection that vaccination should be repeated every three years until it no longer takes. Where previous good vaccination is not shown by white net-like scars, aggregating at least one square inch in area, particular care should be taken to get efficiently vaccinated.

The first principles of vaccination came from the East, and thereon rests the basis of modern preventive medicine. The Chinese practised inoculation of mild smallpox as a protection against severe smallpox long before the days of Jenner. It is therefore probable that the Chinese will take up vaccination widely. Smallpox should soon be looked upon as a mediæval scourge only surviving in countries imperfectly civilized.

The establishment of sub-district health stations would assist greatly in providing facilities for vaccination.

There was a marked incidence of choleraic diarrhœa during the hot weather, especially among the Chinese population, but the diagnosis of true cholera was not confirmed in the laboratory. Asiatic cholera may be defined as a specific infectious disease caused by the cholera bacillus. Although an examination was made in the laboratory of more than fifty cases, foreign and Chinese, the cholera bacillus was not found. The affections with which Asiatic cholera may be confounded are cholera nostras, the severe choleraic diarrhœas not caused by the cholera bacillus, and ptomaine poisoning from bad food. The clinical picture and the *post-mortem* signs in these conditions are identical, so that diagnosis can only be conclusively made in the laboratory. The cases which arose were therefore not held to be true cholera.

Attention was directed to the need of personal care in preventing the group of bowel diseases characteristic of life in Shanghai, which includes cholera and allied conditions, typhoid fever and dysentery and allied conditions. The same methods of prevention apply to all, namely, to eat and drink nothing that has not been recently boiled or cooked or otherwise sterilized.

Living in an alien country, the only sure way of securing purity of food is by sterilization. Sterilization means freeing from micro-organisms, especially the bacteria of disease. Sterilization may be accomplished best of all by heating to boiling point, as by cooking and boiling. The Berkefeld filter sterilizes water, provided the filter candle be boiled once a week at least. Canned goods, including butter, are necessarily sterilized during the process of canning, otherwise they would not keep. Bottled beverages of good reputation are practically devoid of dangerous bacteria. Ice is not sterile, and should not be put into drinks. Fresh fruit, tomatoes, melons, &c., may be effectively sterilized, without spoiling the flavour, by immersion for a few seconds in boiling water, any infection that may be present being invariably on the surface, provided the fruit be sound.

If the simple rule be observed of eating and drinking nothing that has not been recently cooked or boiled, or otherwise sterilized, it is practically impossible to contract any of these bowel troubles to which the Shanghai resident is especially prone. When this fundamental fact is grasped, "chills," "livers," and "cholera belts" will cease to be considered matters of importance.

The incidence of typhoid fever remains an important factor affecting the public health. The fatality of the disease, now that para-typhoid fever and Malta fever are less frequently included, more

nearly approaches the true type. In nearly all cases where the origin was investigated, obvious breaches of the ordinary rules of health, as laid down in the public health notice, were observed.

The infection of typhoid fever may be conveyed by vegetables and oysters which have been contaminated with infected ordure, by water, by milk contaminated with infected water, through the air by means of infected dust, and directly from persons suffering from the disease or who act as "typhoid carriers" subsequent to recovery. Typhoid fever is a preventable disease, its prevention being largely a matter of individual care in the observance of the rules set forth in the public health notice which has been issued to all applicants at the Health Office.

The cause of typhoid fever is practically always taken into the body with infected food, and the foods most commonly infected are vegetables, by reason of the manner in which they are grown. Especial stress should be laid on the fact that vegetables are frequently the source of infection with typhoid fever, cholera, dysentery, and other forms of diarrhœa, and particular care should be given to their thorough cooking, and separation before cooking from the rest of the food. The larder or room for storing uncooked food should be separated from the pantry or serving-room where table utensils, ice-chest, bread, milk, Berkefeld filter and cooked food are kept. There should be a washing-up sink in the serving-room so that table utensils need not be taken into the kitchen to be washed. A place for the washing and preparation of vegetables in the yard outside the kitchen prior to cooking is an additional precaution that may be recommended.

The incidence of diphtheria has not been marked and the case fatality small and probably due to a general use of antitoxin, which is now one of the staple products of the laboratory. Diphtheria antitoxin has been used in most cases notified, and to some extent contacts with those infected have received prophylactic injections. It is supplied free to indigent patients in Shanghai on the recommendation of any local physician.

In any case of suspected diphtheria, antitoxin should be given at once, without waiting for the result of the bacterial diagnosis. The dose for curative purposes is 2,000 units upwards, and that for prophylaxis 500 units.

Although scarlet fever has hitherto failed to establish itself firmly in any part of Asia, excepting Asia Minor, and is practically unknown in the Tropics, it appears to have come to Shanghai to stay; the incidence, however, has been small both among foreigners and Chinese.

Scarlet fever was practically unknown in Shanghai prior to 1900, when it was probably introduced by foreign immigrants. As would be expected with a recently-introduced disease, against which evolution has afforded no natural immunity, scarlet fever has been of a virulent type among the Chinese. It is probable that the passage of the disease through the susceptible Chinese has led to an intensification of the virus, so that it is more fatal to foreigners also.

Early notification, isolation and disinfection are especially necessary in dealing with such a fatal and infectious disease as scarlet fever is in Shanghai. The commonest mode of infection is from a previous case either by contact, by proximity, or by means of infected articles. The infection is given off by the breath in coughing and speaking, by the secretions of the mouth, nose, ear and throat, and later by the peeling skin.

The incidence during the year was sporadic and indicates need for careful isolation and disinfection to prevent an epidemic recurring among the vast mass of susceptible material which exists in the Settlement.

The prevalence of tuberculosis remains at the same high level. Something has been done by widely distributing the Tuberculosis Prevention Notice, by the fugleman reciting the same to crowds gathered by a bell and by careful investigation of all cases notified so as to ensure disinfection of the infected spit.

The enormous death-rate is significant of local conditions of overcrowding, against which there is at present no legislation. The prevalence of tuberculosis bears little relation to climate but is common wherever man closely aggregates. Indiscriminate spitting and deficient air space are the chief causes of consumption. The spit of consumptives being infectious, should only be received into receptacles which can be burnt or boiled, or the contents destroyed by strong antiseptics, fire, or boiling water.

*Plague.*—Plague-infected rats having been found in December, 1908, a complete plague survey of the Settlement was maintained throughout the year. 17,364 rats were found dead and brought to the laboratory for examination, and of these 187 were plague-infected. The following number of plague-infected rats was found during each month, namely: 27, 30, 40, 21, 10, 1, 2, 2, 1, 5, 20 and 28. The increase in the number of those found plague-infected towards the end of the year may be due to (1) a seasonal incidence, (2) cessation of rat-poisoning operations during the hot weather, or (3) re-introduction of infection from outside Shanghai. A system of rat destruction was put into operation, which was at first concentrated on areas within a hundred yards of where infected rats had been found, and, when these had been thoroughly worked, was made general throughout the Settlement. For this purpose some 5,000 break-back traps were used. During the year nearly 92,000 rats were trapped and burnt. These, with the rats found dead and examined for plague, brought the total number of rats visibly accounted for to nearly 110,000. In addition to the trapping, close on seven million phosphorus baits were laid, about three tons of poison being used, which proved a powerful method in dealing rapidly with infected foci. Poisoning on so large a scale carried with it

certain risks, namely: there were four cases of poisoning, fortunately not fatal, among children, and a few deaths among domestic animals. Since using poisoned cakes coloured bright blue instead of the usual method of spreading the poison on bread, no cases of adventitious poisoning have, however, been reported. In the absence of any serious attempt at rat-proofing houses on the part of property owners, over 20,000 houses, not keeping cats, were temporarily rat-proofed and pulicidally disinfected; bedding, &c., being passed through the steam disinfector. This temporary rat-proofing consisted in the plastering up of rat-holes, bricking up and wire-netting places permitting ingress of rats into houses, the furniture of the house being removed to permit of thorough examination for rat holes and runs. 409 persons, mostly members of the Health Office staff, were vaccinated against plague by Haffkine's method.

The most dangerous places as regards plague preventive measures were Li Hongkew and Chapei, on the borders of the Settlement, where plague-infected rats had been found. After considerable trouble the sanitary staff was permitted to extend rat-destruction operations outside the Settlement into these insanitary neighbourhoods. No preventive measures whatever were undertaken by the Chinese municipal authorities, although the methods used within the Settlement boundary were fully explained and co-operation urgently requested. This circumstance clearly demonstrates the need of an extension of the Settlement for purposes of sanitary safety, for, were it possible to keep plague out of the Settlement by energetic sanitary measures, there would, under present conditions, be constant danger of re-infection from the insanitary and populous places immediately outside the boundary which are now, unfortunately, beyond sanitary control.

A noteworthy feature has been the absence of any marked degree of opposition from the native community, co-operation being given to a greater extent than would naturally be expected, a circumstance which is considered to be due to the use of tact and forbearance and especially to the use of the Chinese language by the foreign staff, who thus get into much closer touch with the native community. In cases where exemption from temporary rat-proofing operations was claimed on account of the work having been done by the occupiers, especially where it was found that cats were kept, the sanitary staff have invariably, where possible, carefully respected the wishes and feelings of native residents.

As the adoption of the above preventive measures was followed by a marked improvement in the general condition regarding plague-infected rats, as cases of plague in man are held to be almost entirely dependent upon its prevalence among rats, and as no cases of plague among the human population occurred, the community had every reason to congratulate itself on having escaped a danger, the magnitude of which had never before been experienced in Shanghai so long as sanitary records have been kept. Having practically freed the Settlement of plague-infected rats, it became necessary to see whether further steps could be taken to insure that plague-infected rats would not again be introduced by ships from plague-infected ports. If nothing further could be done by the Port Health Authority—the Imperial Maritime Customs—it was considered advisable to make the plague-prevention staff a permanent organization. It would, however, appear desirable that ships coming from plague-infected ports should be required to present a certificate of freedom from rats, that precautions be taken in the harbour in unloading such ships and that a health officer, acquainted with modern port health work, be appointed to organize such preventive work in the harbour, in addition to the work at present being done at the Woosung Sanitary Station.

Of the rats examined in the laboratory, about 70 per cent. were *Mus rattus*, and the remainder *M. decumanus*—*rattus* being the black or ship rat, which usually lives in houses, and *decumanus*, the brown or sewer rat. There was a large proportion of *rattus* among those plague-infected. Of the fleas, *Pulex cheopis* and *Ceratophyllus fasciatus* have been identified, the former being the flea usually associated with the spread of plague from rat to man.

In formulating anti-plague measures the rat has been the chief objective, as it is held that the rat is the essential cause of epidemics, the flea being the carrier of infection from rat to rat and from rat to man, infection from human cases, which is practically limited to the few pneumonic cases which arise, being comparatively rare. The dictum "No Rats no Plague" has been taken as a working basis, and a house that is rat-proof has been considered for all practical purposes plague-proof.

Quite a number of cases of malarial fever, mostly of the benign tertian type, are contracted in and around Shanghai.

Periodic examination has been made of mosquitoes collected from each of the eight sanitary districts into which the Settlement is divided, and the following have been found: *Anopheles sinensis* (malaria bearing), *Stegomyia scutellaris* (yellow fever bearing), *Culex fatigans* (the host of filaria), and *Armigeres ventralis*.

The prophylaxis of malaria resolves itself into (1) suppression of mosquitoes, (2) prevention of infection of man by mosquitoes, (3) prevention of infection of mosquitoes by man.

Every effort should be made by householders to do away with all receptacles of stagnant water, where mosquitoes breed, such as ponds, water-plants, aquaria, drains out of repair, abandoned tubs, pots, tins and what not. The mosquito net should be assiduously used wherever there are mosquitoes, and especially in up-country houseboat trips. It is doubly necessary to surround a person suffering from malaria with mosquito netting to prevent mosquitoes being infected and acting as carriers of infection.

An account of the special mosquito extermination work will be found later under that heading.

The incidence of beri-beri among the municipal prisoners has increased, deaths having occurred from this disease at the gaol. The cause of this disease remains under close observation, though up to the present wrapped in obscurity. The evidence preponderates in favour of the disease being an infective one, having no direct relation to food and infective through body vermin. The recommendations regarding the admission of municipal prisoners will, if adopted, settle the latter point.

Dysentery, with liver abscess as a not infrequent sequel, showed a marked increase during the year, there being twenty-one fatal cases as compared with five last year. It would appear that, unlike the type of dysentery prevalent in Japan which is bacillar in origin, of relatively greater fatality and unattended by liver abscess, that which occurs in Shanghai is mostly amœbic in origin and prone to produce liver abscess. As regards prevention the remarks made under cholera apply with equal force to dysentery.

Acute lobar pneumonia, which was very rare prior to 1898, has in subsequent years caused 8, 0, 8, 2, 2, 6, 4, 1, 10, 4 and 3 deaths respectively among resident foreigners.

*Rabies.*—Seven persons were bitten by rabid dogs within the Settlement during the year and subsequently underwent the Pasteur treatment. The virus of rabies in Shanghai dogs is of an exceptionally intense character, the period of incubation being shorter than the rabies met with in dogs in Europe. An account of the work of the Pasteur Institute will be found under the heading of "Laboratory."

### *Leprosy.*

Leprosy is a disease which so seldom concerns foreigners in Shanghai that its study is somewhat neglected. Cases are met with occasionally, though it seldom figures in the death statement of either foreigners or natives. There appears to be no urgent call for preventive measures.

### *Dengue.*

From its home in the Malay Archipelago, dengue has frequently during recent years spread up the coast ports to Shanghai. It very rarely kills, but frequently incapacitates from work a large section of the community. It is an intensely infectious disease, spreading in mass like influenza, but appears not to be spread by contagion. A few sporadic cases were met with during the year.

### *Relapsing Fever.*

Relapsing fever again made its appearance among municipal prisoners. The examination in the laboratory of the blood from certain fever cases has shown that relapsing fever is probably quite common among the Chinese population and occurs also to some extent among foreigners. It is probable that this fever is much more prevalent in Shanghai than has hitherto been thought, a circumstance which may help in the future to clear up certain obscure cases of fever.

It is probable that infection is determined by the presence of body vermin, and measures which ensure their destruction will prevent the disease spreading.

### *Cattle Plague.*

Cattle plague appeared in some of the dairies in the western district during the year. The mode of incidence appears to show that its origin is not in food, nor is the infection carried by the coolies, but that insects are the probable means of spread. Immunization by Koch's gall method was offered to all the Chinese dairies, but almost invariably refused. The ordinary preventive measures of isolating sick animals and thorough disinfection were carried out. Six cattle were rejected at the slaughterhouse, as against seven, seven and fifty-six during the years immediately preceding.

Dairies continue from time to time to lose animals from cattle plague, a loss which could largely be prevented by intelligent co-operation with this Department. The policy has been to offer Koch's method of immunization to all dairies, but there has been little response. It is hoped, however, that with the increasing knowledge of Chinese on the part of the sanitary staff, confidence between the dairyman and the Health Office may be established and permit of this useful measure being taken advantage of, as it must be remembered that the greater the dairyman's loss from disease the higher will be the price of milk.

The immunizing material is prepared as follows: An animal dying of cattle plague, the belly is opened, and the diagnosis confirmed by finding the pyloric region, both of the stomach and bowel, congested and eroded. The gall bladder is then seized around the neck and excised by cutting into the liver substance. The cut surface of the bile duct is sterilized by washing with cyllin, 1 in 50, and the gall jetted into a sterile wide-mouthed bottle. The gall should be clean and green, and, if thick and red should, unless very carefully glycerinated, be rejected. An equal quantity of glycerine is then thoroughly mixed with the gall and after repeated shaking is ready for use after seven days. Koch, the originator of the method, found, and it has been subsequently observed by other workers, that fresh gall or glycerinated gall kept less than four days may sometimes convey infection. The use of glycerine with the gall, however, completely removes this disability within a few days and renders its use absolutely safe. This method has been used for immunizing over 300 dairy cattle in Shanghai with no untoward result. The immunity, however, does not last long; so that the injection of Koch's glycerinated cattle plague gall should be repeated every six months. It is held that, were all the dairy cattle twice yearly thus injected, cattle plague would run a very poor chance of spreading.

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PUBLIC HEALTH LABORATORY.

Inasmuch as the study of the life-history of pathogenic organisms must precede all adequate measures for preventing the diseases which they cause, no pains have been spared to develop the resources of the Municipial Laboratory. It is the centre of work of the Health Department. Its purposes have been the investigation of diseases met with in Shanghai, the diagnosis of infective disease, the preparation of preventive and curative remedies against these diseases, and the analysis of products bearing on the Public Health. The matters which have been under investigation have been the causes of variation in virulence of small-pox vaccine, cholera antitoxic serum, the natural filtration of water through alluvium, the suitability of fruits and vegetables as media for the growth of certain pathogenic organisms, preventive inoculation against cattle plague, the causation of beri-beri, the incubation period of rabies in China, the prevalence of Malta fever and the natural disposal of organic matter in house refuse.

*Pathological Diagnosis* is being more and more utilized not only by local medical practitioners, but by those in the outports. 18,265 specimens were examined, as against 2,240 last year.

*Analyses.*

*Milk.*—383 samples have been examined during the year and of these 75, or 19·3 per cent., were returned as adulterated. Nine out of the 75 were found to be deficient in fat and the remaining 66 contained added water, the extent of the adulteration being indicated in the following table :—

| | | | | | |
|---|---|---|---|---|---|
| 34 | specimens | contained | from 1 to 10 | per cent. | of added water. |
| 13 | ,, | ,, | ,, 10 to 20 | ,, | ,, |
| 6 | ,, | ,, | ,, 20 to 30 | ,, | ,, |
| 5 | ,, | ,, | ,, 30 to 40 | ,, | ,, |
| 7 | ,, | ,, | ,, 40 to 50 | ,, | ,, |
| 1 | ,, | ,, | ,, over 50 | ,, | ,, |

One specimen was found to consist of a mixture of ordinary fresh milk and diluted condensed milk. The addition of bean curd to watered milk appears to have ceased, as none of the milks examined were found to contain starch. During the summer months a number of samples were tested for the presence of artificial preservatives, but in no case was any found. Comparing the number of samples of milk examined with the percentage found adulterated for the three years, 1907, 1908 and 1909, a progressive improvement in the quality of the public milk supply is shown, as follows :—

| | 1907 | 1908 | 1909 |
|---|---|---|---|
| Number of samples examined .. | 345 | 365 | 383 |
| Percentage found adulterated .. | 35 | 24 | 19·3 |

*Water, Aerated Waters and Ice.*—Twenty-seven specimens of drinking water and four of water intended for industrial purposes have been examined chemically. The results of the monthly analyses of the Shanghai Waterworks water are appended in the following table. The variation in composition is chiefly a matter of concentration or dilution, the relation between different figures remaining practically constant.

*Gas.*—The Shanghai Gas Company's gas has been examined from time to time for the percentage volume of carbon monoxide. This, one of the chief constituents of water gas and very poisonous, should be limited to a maximum of 15 per cent. The volume found has varied considerably but has been well within the limit each time.

*Food, Liquors, &c.*—Food analyses have comprised butter, milk-fat, condensed milk, &c. A specimen of milk sugar sent in was found to contain a considerable percentage of tartarated antimony. Whisky, brandy and samshu have been the chief liquors under examination. Potent drugs intended for use in the hospitals have been assayed and standardized whilst others have been tested for purity.

*Anti-Opium Remedies.*—Twelve native medicines have been examined for the presence of morphine or opium. Of these eight were found to contain morphine in varying amount, one contained nearly 50 per cent. of opium and three were free from either morphine or opium.

*Miscellaneous Analyses.*—These include analyses of albumen, urine, chemicals, coal, lubricating oils, &c.

*Manufacture of Rat-poison.*—During the past year the resources of the Laboratory have been utilized in the production on a large scale of rat-destroying preparations. Preliminary experiments indicated that a preparation of yellow phosphorus—a deadly irritant poison—although attended with danger in the manufacture, would be the most efficient and economical poison, and, with the exception of a small amount of an arsenical biscuit, all the poison produced has been a phosphorous preparation. Altogether some ninety pounds of phosphorus, suitably emulsified and incorporated with a basis of sugar and flour, flavoured with anise and molasses, has been used, representing about 6,500 lb. of poison. With a view to minimizing risk to children the poison has been coloured a distinct and permanent blue.

The supply of glycerinated small-pox vaccine has been widely distributed throughout the Far East. 16,879 tubes were sent out from the Laboratory during the year—the equivalent of 84,395 persons protected against small-pox. The number of tubes of vaccine issued from the Laboratory in successive years since 1898 has been 5,000, 6,000, 22,500, 13,000, 12,000, 34,000, 28,500, 21,432, 15,958, 19,995 and 16,879 respectively. The vaccine is sent out in tubes sufficing for five vaccinations, each tube bearing a label marked "Shanghai Municipal Laboratory," the date of issue from the Laboratory, and the number of the calf yielding the vaccine, so that any fault can be traced to the source. The vaccine is guaranteed to produce successful results for one month after the date marked on the tube, if kept under suitable conditions. Vaccine is also sent out in bulk in rubber corked tubes containing one or more grammes, in which form it is convenient for making a large number of consecutive vaccinations.

As light and heat destroy the vaccine virus it is advisable to use it as fresh as possible and to keep it

in the dark and, during high temperatures, in an ice-chest. The vaccine is glycerinated and kept in the Laboratory before issue with the object of eliminating extraneous organisms. It is obtained from calves proved healthy by *post-mortem* examination and is tested as regards purity and activity before issue.

Small quantities of Haffkine's plague prophylactic, typhoid and other bacterial vaccines, mallein and tuberculin have been sent out from the Laboratory.

Two horses are kept for the production of diphtheria antitoxin and a good degree of immunity has been established, using Park's diphtheria bacillus for the production of the toxin. 1,022,000 units have been sent out from the Laboratory to meet the needs of Shanghai and the outports. Preparations were made to produce Yersin's anti-plague serum but had to be suspended owing to want of accommodation in the present Laboratory building.

*Anti-Rabic Treatment of Pasteur.*—Since the opening of the Shanghai Pasteur Institute in 1899, 268 persons have received the treatment. During the past year twenty-eight persons were treated. The animals were proved rabid by inoculation in four cases; in nine, rabies was diagnozed by a competent observer, while in the others they escaped observation, so that the suspicion could not be verified. Ten of the cases were the result of dog bites within the Settlement. All these cases, so far as is known, have escaped hydrophobia.

Forty-seven dogs were admitted to the Observation Kennels, five of which proved rabid. Ten dogs suspected of rabies were examined in the Laboratory, and of these six were proved rabid by inoculation.

The incubation period of rabies in rabbits inoculated with the brain of dogs sent to the Laboratory for examination averaged fourteen days. That the virus of rabies met with locally is of an exceptionally intense character may be concluded by comparing the above incubation period with that met with in Europe, which varies from fourteen to twenty-one days.

The year has seen a further extension of the Municipal hospital system, the object being its concentration in the vicinity of the Isolation Hospital and Nursing Home so as to facilitate supervision by the Asssitant Health Officer in charge, and to co-ordinate this part of the work of the Health Department.

In order to provide for adequate training of native nurses for the Chinese hospitals under the Department, the learning of Chinese has been encouraged, and there are now four nurses studying the language with this object.

Isolation for cases of infectious disease is provided at the Isolation Hospital, Range Road. There is a separate hospital for Chinese cases. Admission to either hospital is voluntary and the institutions are for the benefit not only of the patients admitted but of the community. Every endeavour is made to make the hospital as comfortable as possible and the surroundings pleasant, while the fees are arranged so that in no case may the question of payment of fees prevent anyone from coming into the hospital. The fees for admission to the foreign hospital are Tls. 6 a day for private rooms, and Tls. 2 a day wards wherein free beds are available for poor people. Wherever possible the patients or their friends arrange for medical attendance. Admission to the Chinese hospital is free, but a small charge is made for private rooms. In the Chinese hospital patients may be attended by their own native doctors if they so desire. Considerable improvement is expected to result from the organization of the nursing of Chinese under the supervision of the matron.

Ambulances are provided for the conveyance of patients suffering from infectious disease to the Isolation Hospital. Other vehicles used for conveyance of cases of infectious disease to the hospital are detained at the hospital until disinfected.

More accommodation is needed for cases among foreigners of minor infectious disease, such as measles, chicken-pox, mumps, and erysipelas, and for observation of cases before diagnosis is confirmed. Should there be an outbreak of plague when both small-pox and scarlet fever were prevalent, the accommodation at present provided would be inadequate. Isolated accommodation is also required for cases of tuberculosis among foreigners, for which there is at present no adequate provision in the Settlement. Were this provided on the Isolation Hospital site and worked in combination with a branch of the Municipal Sanatorium at Mokanshan, benefit would accrue both as regards the prevention and treatment of this disease. At present, if a case of consumption occurs in a family, which cannot afford to send the patient away to a proper European or American Sanatorium, he often has to remain at home, becomes a source of infection to those with whom he comes in contact and lives under conditions which render small the chance of cure. On the other hand were there adequate accommodation for isolation and treatment it would then be possible to remove the patient to hospital, where the hygienic conditions would tend towards cure and a dangerous source of infection would be removed from the patient's own home. There is also need for dispensaries in different parts of the Settlement for the treatment and education in the means of prevention of Chinese cases of tuberculosis, for a hospital for advanced cases and for a sanatorium for the treatment and isolation of curable cases.

*Victoria Nursing Home.*—The accommodation provided by the Nursing Home has been fully occupied by patients throughout the year, a considerable number of cases having been refused admission on account of want of room.

There are now some twenty nurses on the staff, not including probationers in training. The Nursing Home was built ten years ago, before the phenomenal growth of the Settlement, and was designed to accommodate six nurses and four probationers. To provide accommodation for the increased number of nurses a dwelling-house adjoining the Home was acquired; but more room for the nurses is necessary, as it is considered inadvisable to accommodate more at the Isolation Hospital than are wanted for actual nursing. It is held that the best way of providing this accommodation for the nurses, and at the same time

improving the accommodation for patients, will be to use the present building as a nurses' residence and build a new Nursing Home in keeping with modern hospital requirements on the vacant land already acquired by the Council alongside the present building.

The mental wards adequately fulfil their present function. Thirty-five cases were received during the year. Admission is procured by the signature on Form A or Form B obtainable from the matron. Form A requires the signature of the person immediately responsible for patient, who undertakes responsibility for payment of fees, provision of medical attendance, for procuring any order that may be required by the law of the country to whom the patient belongs, and for removal of patient after six months if still remaining in the wards. Form B is used when no one immediately responsible is forthcoming, the responsibility then naturally devolving upon the Consul of the nationality of the patient. There still remain cases where a Consul will not assume responsibility and it remains to make some sort of humane provision for these cases to prevent them from becoming a nuisance or a danger both to the public and themselves, and at the same time to keep the mental wards from being filled with chronic lunatics, for which class of case they were never intended.

*Sanatorium.*—Upwards of seventy municipal employees were received during the year. Some of these were convalescent after illness and others so run down in health that sanatorium treatment was advisable in the interests of the Service. The present building was filled to overflowing and the general consensus of opinion among the visitors was satisfactory as regards benefit to health and enjoyment, and confirmed the opinion held that Mokanshan is the best available place for a municipal sanatorium for Shanghai. Having proved its suitability as a municipal sanatorium, an adjoining commodious bungalow and grounds have been acquired. Occasion has often arisen when patients at the Nursing Home, without the means of taking a holiday, would be greatly benefited by a course of sanatorium treatment. There are again many cases where treatment, from the beginning, would be more likely to be successful at the Sanatorium than at the Nursing Home, and this is especially the case with tuberculosis, a disease very common in Shanghai. For these and other reasons a Sanatorium, run in conjunction with the Municipal hospital system, is desirable, and the present one at Mokanshan may form a nucleus.

Horse ambulances are provided for the transport of patients to and from the municipal hospitals at a cost of $3. Hand ambulances are available free of charge. For emergencies hand ambulances are available at all the police stations.

*Sikh Police.*—The health of the Sikh police during the year has been satisfactory. As among other sections of the community intestinal disorders were more prevalent than any other, showing the need for careful supervision of food-supply and messing arrangements. Tuberculosis continues to be the commonest cause of invaliding out of the Service; eight such cases occurring, in each of which the diagnosis was confirmed in the Laboratory. During the winter especially, the Sikh, in Shanghai, likes to live under conditions favourable to the transmission and development of tuberculosis, namely, in hot, ill-ventilated and overcrowded rooms, so that attention to these points is necessary in those immediately responsible for their welfare. The quarters at the police stations are adequate and capable of proper ventilation; spittoons are provided containing disinfectant and indiscriminate spitting is forbidden, Venereal disease accounts for a relatively large number of the sick. The average number of days off duty on account of sickness for each member of the force was eight.

*Chinese Police and Prisoners.*—The police hospital (Chinese) was opened towards the end of the year, and during the coming year a system of inspection of prisoners will be organized at the police stations, working in conjunction with this hospital, which should result in improving the sanitary conditions under which the prisoners live. A resident foreign nurse is in charge of the police hospitals (Sikhs and Chinese) and a resident native house-surgeon at the police hospital (Chinese), working under an Assistant Health Officer who has charge of both these hospitals and the gaol infirmary.

*Gaol.*—The number of prisoners admitted to the gaol increased from 1,630 in 1908 to 2,951 in 1909; the average number of prisoners in the goal has increased from 777 in 1908 to 860 in 1909; the number of sick increased from 491 to 810; while the number of deaths increased from 25 to 77, the disportion being due to beri-beri. Since the opening of the gaol until the beginning of the present year the incidence of Beri-beri was remarkably small. During the present year, however, the number of prisoners has still further increased; short-sentence prisoners have been admitted and prisoners have been admitted in such a manner that the gaol is now infested with body vermin. This has resulted in an increased aggregation of potentially infective units under conditions of overcrowding, accompanied by the presence of body vermin as transmitting agents, a combination of circumstances which is held to contribute directly to the spread of beri-beri. There is need of greatly increased care during the admission of prisoners to the gaol so as to ensure that none but perfectly clean, vermin-free and healthy prisoners are allowed to mix with the general body of prisoners. Proper admission and bathing arrangements, which should provide for the bathing of each prisoner in clean water, the separation of clean from unclean, infected or verminous clothing, and the medical inspection of all prisoners before admission to the body of the gaol, were recommended more than a year ago and are now more than ever urgently needed.

### Sanitary Inspection.

The foreign Sanitary Inspection Staff is now composed of four inspectors and sixteen assistant

inspectors. The inspectors, with one exception, possess both the sanitary inspector's and the food inspector's certificate of the Royal Sanitary Institute, while four of the assistant inspectors possess the sanitary inspector's certificate of the Royal Sanitary Institute. By means of a system, inaugurated two years ago, of examinations in sanitary knowledge as applicable locally, divided into three stages, each carrying a bonus, it is intended to train up health inspectors recruited locally.

The outbread of plague among rats and the urgent need of many sanitary measures not previously required make the want of sub-district depôts or health stations acutely felt, which was met by renting a Chinese house in each sub-district. It is recognized that true efficiency can only be obtained by having the assistant inspector resident in his district. The sub-district depôt would provide this residence for the assistant inspector, a depôt for the storage of house refuse barrows, and ordure buckets, which are at present of necessity left lying about the streets and alleys, and for the storage of other sanitary and disinfecting apparatus and stores, quarters for the disinfecting staff, a room for vaccination and lectures on sanitary subjects, and an office for the registration of natives' deaths. Such a sub-district depôt or health station would cost, for the land and buildings, from Tls. 10,000 to Tls. 30,000, according to location, or a total cost of about Tls. 210,000 for the whole Settlement. As such a measure would result in greatly increased efficiency of work and is, in fact, necessary for proper working of the department, the scheme should be carried through as soon as circumstances permit, so as to allow of the further organization of sanitary work which has been and should continue to be progressive.

The finding of plague-infected rats brings up acutely the question of the insanitary condition, of houses built according to the Chinese building rules, against which protest was made at the time the rules were made, and repeated last year. It is held that a house which provides places where rats may obtain seclusion is, on account of the special danger which the Settlement runs from plague, insanitary. At present the space left between the floor-boards and the ground becomes a receptacle for any filth that finds its way between the floor-boards and provides a home for rats and enables them to make an entry by means of the wooden framework into any other parts of the house which are hollow, such as the space between the ceiling and the first floor, and into the roof space and among the tiles, in all of which places rats may find seclusion. In this way plague, which almost invariably is spread by rats, may get into a house and infect the residents in such a way that little short of actual demolition could eliminate, a circumstance which would render it practically impossible under present conditions to shake off plague once effectively introduced into the Settlement. The basement of a Chinese house should therefore be solid; cement in the cookhouse and yard and wood in the living-room laid directly on tar macadam, or similar material, impervious to water and rats. Wooden floors if properly laid in this way will in actual practice last longer than when an open, ill-ventilated space is left below. The space below the basement floor is now usually little more than a receptacle for garbage, which never has a chance of being cleaned. There is usually a hollow space between the ceiling and the first floor, in lath and plaster partitions, between the ceiling of the second storey room and the roof, and in stair linings against which hollow spaces the same reasons apply. As usually erected also the wooden framework of a Chinese house often affords a run for rats, and some means should be taken to fill in the holes with plaster and by more careful bricklaying. Hollow brickwork should not, if properly done, be insanitary, but, as a rule, rats can easily make a run through these loosely laid and improperly plastered materials.

*Foreign Dwellings.*—The attention of architects is called to the clause in the public health notice headed "Kitchen," wherein it is suggested that every house should, if possible, have a separate larder (place for storing uncooked food), kitchen and serving-room. The serving-room should be fitted with a washing-up sink, Berkefeld filter, shelves for all the table utensils, groceries, &c., and room for the ice-chest. It is held that the separation of the serving-room from the kitchen is an important means of preventing those food infections which are so prevalent in Shanghai and which are brought into a house chiefly by infected vegetables. Cooking destroys the infective material, and food that leaves the kitchen should reach the table without contamination. This can be insured by having table utensils kept in, and the service of food done from, a serving-room kept quite separate from the kitchen. The serving-room should be rather a part of the dining-room than of the kitchen. As an additional safeguard a place for the washing and preparation of vegetables prior to cooking should be provided in the yard outside the kitchen. A great number of foreign houses lack proper serving-rooms and use the space under the staircase for that important purpose. This space is usually too small, dark and ill-ventilated and is often without washing-up sink. The wooden zinc-lined sinks are frequently abominable, and glazed earthernware sinks with proper waste pipes of lead should replace them.

Many foreign houses are infested with rats which, should plague become prevalent, may become a source of great danger. In these houses the gratings under the ground-floor are generally found loose or broken so that the interior of the house is easily accessible to rats, which then make use of all the hollow spaces which ceilings and lath-and-plaster partitions provide. It is advisable to have the ground-floor as far as possible solid. The floor of the kitchen, larder and outhouses should certainly be solid and of cement if possible. Lath-and-plaster partitions are better avoided, but if used may be made fairly rat-proof by being made solid for about a foot from the floor, as rats generally obtain access by gnawing through near the floor level. The reinforced concrete method of construction is well suited to local conditions in view of the need of rat-proofing buildings.

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Those about to rent houses are advised to ask the Health Officer for a sanitary inspection and a certificate of good sanitation before closing with the landlord.

The disposal of house refuse is beset with difficulties, but improvements are gradually being effected in the methods adopted. Careful checking has accounted for nearly every ton sent away from the shoots. The cost of disposal was $6,439, as against $8,305 last year. Further efforts have been made to encourage "country boats" to come to the shoots and remove house refuse for agricultural purposes, and of the total quantity brought to the shoots nearly half has been disposed of in this way, and of that remaining one-third was barged away and dumped at the depot, and one-fifth was used for raising low-lying ground within the Settlement.

Experiments extending over ten years on the natural disposal of organic matter in house refuse, with frequent observation of the garbage heaps, tend to show that within a year and a half all the decomposable organic refuse disappears by oxidation, which is tantamount to slow combustion—the heat generated spontaneously in a garbage heap being very considerable—and leave an innocuous mass, without smell, which forms a suitable material for filling in low-lying ground and shallow stagnant pools. It is not necessary to go so far as to recommend its use for raising building sites to be used within five years, but it would be excellent material for raising garden sites and for filling the holes left near houses by the excavation of mud if not below the ground-water level. In the large garbage heaps at the depot, the nuisance from smell and flies disappeared after three months; and in properly conducted filling-in operations it is possible by covering recent house refuse with a layer of clean earth to remove nuisance from these causes and at the same time promote oxidation and destruction of the objectionable organic matter. It is hoped, therefore, that anyone desiring such filling-in operations will communicate with the Health Officer. In this way it is hoped to avoid to some extent the further objectionable accumulation along the banks of the creek and the dumping of garbage into the waterways, which is difficult to entirely prevent. When it is remembered that every stagnant pool means mosquitoes, which are the potential cause of malaria, it is held that any temporary nuisance that may occur during the course of filling-in is outweighed by the sanitary advantages which accrue. This method, therefore, is advisable both from the point of view of economy and sanitation. Unfortunately, distance prevents the use of this method for the refuse from the crowded districts of the centre of the Settlement, unless some arrangement could be made with the Tramway Company for cheap and rapid transit of house refuse in large quantity.

As it is becoming more and more difficult to rent suitable dumping places for house refuse, the purchase of one or more sites is now recommended, so as to provide such permanent depots near the centre of the Settlement as will afford easy access for inspection, with the object of preventing dumping in the water, to enable boats to return to their shoots by the following morning and to facilitate disposal of the material within the Settlement for raising and filling-in purposes. In this way it is hoped that the whole of the house refuse of the Settlement will be disposed of in an efficient and sanitary manner, giving rise to no permanent heaps, and banishing, as far as possible, dumping in the creeks.

*Drainage and Paving.*—It has been considered a duty in the ordinary course of sanitary inspection, not only to point out sanitary defects but also, when requested, to provide the means whereby these defects can be best remedied, and to supervise the work to completion. In this way the native contractors have been taught the proper way of laying drains, forming cement channels, paving yards and other sanitary work.

The defect usually met with, in the course of inspection, is that of blocked surface drains, due to absence of proper surface inlets. The use of gully traps with hinged grids with lineal openings is desirable, instead of the small circular openings at present so frequently used. Although the standard of drainage is improved, much is still required before the materials used are laid so as to obtain the maximum amount of self-cleansing and ability to stand the test of hard wear and tear. Much of the cement drainage material used by private contractors is of poor quality.

*Creeks.*—Regarding these important natural tide-flushed drains, the object has been the abolition of stagnant water and the maintenance of tidal channels open, clean and clear. The flatness of the Settlement necessitates the maintenance of certain waterways, and the Yangkingpang and Defence Creek are among them. The maintenance of the main artery creeks so as to permit of daily tidal flushing is a vital necessity.

When a creek gets into such a condition that daily tidal flushing is not obtainable, its conversion into a covered sewer is, if it is in a residential district, generally desirable: but the filling in or converting of creeks that are accessible to all tides is seldom advisable.

*Mosquito Extermination.*—As there seems to be a general desire for something more in the matter of mosquito extermination than the plodding work of the last ten years, the object of which has been to eliminate stagnant water by filling in ponds and ditches, the opening and cleansing of tidal creeks and the promotion of surface drainage, a more elaborate plan of campaign was put into operation, which included direct measures for the destruction of mosquito larvæ on private property. A special staff was organized which worked from the middle of April until the end of October. The results, so far as they went, are considered satisfactory, a diminution in the number of mosquitoes estimated at from 25 per cent. to 75 per cent. having been effected. The work of the Chinese staff required very careful foreign supervision, as the results of good work were not directly apparent, and the detection of bad work

required assiduous observation on the part of the foreign inspector. As the staff of the Health Office had been, since the beginning of the year, strenuously employed in warding off the threatened invasion of plague, the assistance of the police was called for and eight men were temporarily transferred for the work, acting under the sanitary inspectors. The work being undertaken at a time when the whole of the staff was overworked should be allowed for in assessing the value of the results obtained. As it was impossible to have the work done under the immediate supervision of foreigners, trial was made of a plan of letting the native staff work in couples, giving them definite areas of operation, paying them well and fining heavily for each dereliction of duty discovered by the foreign staff. The Chinese generally looked upon the work as "fool pidgin," though the inspectors, by roadside lectures in Chinese and practical demonstration of the mode of propagation of mosquitoes, succeeded in many cases in convincing the natives of the simplicity and utility of the measures recommended. The cost of the work was about Tls. 6,000, but it should be remembered that the arrangements were somewhat tentative in character and capable of considerable development. More attention could have been given to the work had not the more important plague prevention operations monopolized most of the time that could be spared from routine work. Mosquito extermination work in Shanghai is by no means easy. In the foreign staff thoroughness and enthusiasm are mostly called for and the goal to be striven after is the total extermination of mosquitoes in the area operated. The men drafted from the police for this work, with two or three exceptions, were unable to fulfil these conditions; and it is expected that the permanent addition of two assistant inspectors, who will receive the special training necessary for this and other sanitary work, will be the best course, should it be decided to go on with the work.

In the Chinese staff it is necessary to have men with intelligence and initiative, who can enter native premises with some degree of authority and get rid of stagnant water without friction or dishonesty. The results required are of a negative nature—absence of mosquitoes—there being nothing tangible to show as an immediate result of the work. Coolies working alone do not like to appear a source of annoyance to householders by too diligently searching their houses for larvæ; this is not felt when they work under the immediate supervision of a foreigner, as any little trouble the people are put to would naturally be attributed to the foreigner.

The work itself was conducted somewhat as follows:—The sanitary districts were divided into areas worked by a couple of coolies; each couple was provided with an oil-can for oiling gully traps and small accumulations of stagnant water which could not be removed, a pail for holding oil, a garden syringe for spraying larger pieces of stagnant water, a broom for sweeping away small accumulations of water, and a spade for cutting trenches, for draining low ground and filling up depressions, &c. Barrow coolies (with two barrels) conveyed oil to the coolies and removed tins, jars and what not, capable of holding water for mosquitoes to lay their eggs in. Every part of and every house in the districts were supposed to be visited weekly, and notices in English and Chinese distributed and explained. The best admixture of oil for the months of April, May and October was found to be half crude oil and half of lamp oil, for June and September two parts crude oil to one part of lamp oil, and for July and August four parts of crude oil to one part of lamp oil. At no time was crude oil alone found to form a good killing film.

Co-operation was obtained from most foreigners but the majority of Chinese showed a complete indifference, amounting occasionally to active opposition. No prosecutions were undertaken to enforce these mosquito extermination measures, but this would appear desirable in flagrant cases after repeated warning.

Against what has been truly described as "the deadly house fly" the careful collection and disposal of house refuse is a measure of primary importance. Among other public measures has been the requirement as one of the conditions of licence in premises licensed for the purpose of safeguarding the food-supply, of adequate means being taken to prevent the access of flies to foodstuffs and the use of perforated zinc in windows and spring doors. The screening against flies is also an important individual measure and should be applied to the serving-room and kitchen; while cleanliness should be maintained in and about the house, so as to deprive the insect of food and of breeding-places.

All the laundries within the Settlement are licensed and regularly inspected. The system of sanitary control has been one of constant inspection, so as to make the licensees reluctant to transgress the terms of their licences rather than one having for its object a large number of prosecutions. It should be noted that the coolies carrying washing to and from the licensed laundries are provided with municipal distributing tickets, so that residents can easily identify the licensed laundries. It is advisable to insist on seeing this ticket from time to time, and as there are several insanitary laundries outside the Settlement, especially in Pootung, which it is impossible to license. If the public, including the shipping community, were were not to patronize these insanitary laundries they would soon cease to exist.

During the year all the premises licensed for public health purposes have been limewashed and cleansing operations of the nature of disinfection have been carried out in insanitary property in many parts of the Settlement.

Applications are still received from time to time for permission to install waterclosets. Foreign Building Rule 76 is, however, quite clear and definitely prohibitive under all circumstances. The main object is the safeguarding of the water supply.

The northern and western limits of the Northern District abut on a most insanitary neighbourhood wherein dwell an increasing population composed chiefly of beggars and other undesirables living under

such unhealthy conditions as to be a serious menace to the health of the Settlement. With plague threatening the Settlement the need for extension for the purpose of sanitary safety is more urgent than ever. A clear interval of at least a mile should be left between the thickly populated parts of the Settlement and the boundary.

The practice of coating urinals with crude petroleum has greatly improved their condition, preventing deposit in a remarkable manner. Trial has been made of lime, bleaching powder, coal tar disinfectant and crude petroleum for the purpose of preventing access of flies and the resulting danger of the communication of intestinal disorders, but with little success. It is now recommended that a trial be made of fly-proofing latrines with perforated zinc.

The removal of ordure continues to be efficiently done and is a source of considerable profit to the community. There is a ready demand throughout the year for use in growing such crops as indigo, and were it not for its employment also in growing market produce for the table, which it is practically impossible to prevent, the method of disposal is more sanitary than any other and as regards the economy of nature nearly perfect.

There is no doubt that the smoke nuisance, which is becoming more and more obvious, could be considerably lessened by intelligent stoking and especially by mechanical stoking. The coal most commonly used is, however, of a smoky bituminous nature.

The circulation of Public Health Notices in Chinese has been found to be a good way of propagating sanitary knowledge. The following notices have been widely distributed, namely: the General Public Health Notice, the Tuberculosis, Vaccination, Cholera, Plague Prevention, Keeping of Cats and Mosquito notices. Each district has its fugleman whose duty it is to collect crowds round him by means of a bell in the alleys and tea-houses, to whom he recites the notice appropriate to the occasion.

Arrangements are being made for the licensing and inspection of premises for the storage of dangerous materials, namely, those which, on account of fire or explosion, may endanger life or property, such as gunpowder and similar nitrate mixtures, dynamite, blasting gelatine, carbonite, nitro-cotton, smokeless powder, picric acid and similar nitro-compounds, chlorate mixtures, fulminates, fireworks, ammunition, benzene and other very volatile and inflammable petroleum products, acetylene, calcium carbide, yellow phosphorus or any material containing any of these as an ingredient in dangerous quantity.

The Public Swimming Bath was open from May 7 to October 31. The number of persons admitted was 13,522, as against 9,831 last year. The increase was due not so much to a greater number of bathers as to the better system of registration effected by the turnstile and to the custom of admitting spectators to the games organized by the International Swimming Club during the evenings of July and August. The bath appears to have been well patronized by all classes, including women and children in the mornings, and to have successfully fulfilled its function.

As the preventable diseases specially prevalent in Shanghai are mostly caused by infected food, food inspection is of paramount importance.

The amplification of Bye-law XXXIV gives power to license fruit, fish, and other food shops hitherto unlicensed, aerated water factories, ice-houses, &c. This brings practically the whole food supply under sanitary supervision, and the work of getting premises into a fit condition for licence has been steadily progressing throughout the year.

The periodic analyses of the water supply by the Shanghai Waterworks Company, show that filtration is carefully done. The bacterial contact has only occasionally been above 100 per cubic centimetre. The question of the prohibition of waterclosets is one that chiefly concerns the purity of the water supply and is therefore of fundamental importance to the community.

*Milk Supply.*—The total number of cattle in the dairies was 974, as against 1,022 last year. The standard of cleanliness in dairies has been maintained. The windows of the milk rooms are now required to be unopenable and provided with perforated zinc instead of glass and the door with a spring slam to prevent ingress of flies.

The licensed butchers, poultry, game, and vegetable shops have been kept in good sanitary condition. Arrangements are being made for the licensing of bakeries, fruit, vegetable, fish and other foodstuff shops, ice-houses, and aerated water factories.

42,247 lb. of unsound fruit, vegetables, &c., were seized. The native ice-cream and cool-drink dealers have received the attention of the inspectors. When the danger of their wares was quite obvious they were confiscated and destroyed. The sale of cut melon has been discouraged.

*Meat Supply.*—The examination of cattle and carcases at the Municipal Slaughter-house affords adequate protection of the meat supply, One hundred and thirteen animals were rejected as being unfit for food, as against ninety-eight last year. No animal was rejected on account of tuberculosis, showing how small is the prevalence of tuberculosis among local cattle. Six cattle were rejected for cattle plague, as against twelve last year.

Good meat is stamped with a circular stamp for beef and a triangular stamp for mutton, pork and veal, with the words "Killed Municipal Slaughter-house" and the date of slaughter. Meat inferior in quality, but free from disease, passed for sale on stalls only, is marked "second quality." No meat is allowed to be sold from any shop or brought into the Settlement unless it bears the Municipal stamp.

Such grease shops as are within the Settlement are under constant inspection, so that no nuisance or danger to public health is caused by them; 1,269 oxen, 2,020 buffaloes, 273 sheep, 196 ponies and 454 dairy cattle were dealt with at these places.

More small markets are required in the Eastern District. The object desired is to have all hawkers of fresh foodstuff in Municipal markets.

CEMETERIES.

*Bubbling Well Cemetery and Crematorium.*—As this cemetery will probably not be filled for another twenty years it is hoped that in the near future, the Bubbling Well corner will be acquired so as to complete the site, removing at the same time a most insanitary and unsuitable neighbourhood, and allow of the carrying out of a broad garden design which will be not only to the advantage of the cemetery, but of the Bubbling Well rendezvous. A portion of the section of the cemetery site used temporarily as a nursery garden has been cleared to allow of the laying-out of more grave spaces.

*Pahsienjao Cemetery.*—The appearance of this fine old cemetery, which is nearly full, has been improved by general repairs and the planting of new trees and shrubs.

*Shantung Road Cemetery.*—This cemetery which contains the mortal remains of many of the earliest residents of the Settlement has been appropriately cared for and now presents a neat appearance. Several new trees and shrubs have been planted.

*Pootung Cemetery.*—Many new trees and shrubs have been planted and the appearance of the cemetery further improved by repairing the gravestones.

*Soldiers' Cemetery.*—This cemetery, from a general latrine, piggery and place for dumping the dead bodies of nameless children, has been converted into a picturesque memorial of those who died in the early strenuous years of the history of the Settlement, 1862 to 1865, during the foreign military defence of Shanghai against the Taiping rebels.

## Colonial Medical Reports.—No. 8.—Colony of Natal.

# MEDICAL REPORT FOR THE YEAR ENDED DECEMBER 31, 1909.

**By ERNEST HILL.**

*Health Officer for the Colony.*

THE year has been notable for low death-rates and morbidity.

VITAL STATISTICS.—POPULATION.

*Europeans* (including Mixed Races).—The estimated population as at June 30, 1908, was 99,745. Between July 1, 1908, and June 30, 1909, the balance between exits and entries by sea and by rail shows a loss of 2,713 persons. In the period the balance by births over deaths shows an increase of 1,903 persons, leaving a net loss of 811.

The population as at June 30, 1909, is estimated at 98,934.

The last census was taken at mid-April, 1904. At that time the population was 101,183. Since then there has been a continued loss of people by emigration, mostly overseas, greater in some years than in others, the greatest loss occurring in 1907.

The only gleam of a satisfactory feature in this alteration is that the loss of population has fallen entirely on the towns, while there has been considerable increase in the numbers of those engaged in utilizing the resources of Nature on the land. The net diminution in numbers is 2,249. In 1904 there were 49,527 persons in the two large towns, and 51,656 living elsewhere: in 1909 the respective numbers were 43,140 and 55,794. That is to say, the number of persons in the two towns of Durban and Maritzburg has decreased by 6,387, and the numbers elsewhere increased by 4,138. The loss in 1908-9 appears to have been principally in Maritzburg, where a census was taken towards the end of the latter year. From a recent informal census in each, the populations of Durban and Maritzburg are fairly accurately known.

*Indian Immigrants.*—The total number on the protector's books on June 30, 1909, was 103,906, as against 104,120, 101,078 98,049, 91,239, in the preceding four years respectively.

*Other Indians.*—Estimated at 18,122.

*Natives.*—Estimated at 996,445.

The present laws requiring and regulating the registration of births, deaths and marriages, are defective in many points which are essential for the provision of adequate information from which proper vital statistics can be compiled.

The laws allow thirty days' grace for the registration of births, even in the towns. The period is quite unnecessarily long, and it debars the medical officers of health from all opportunity to do anything to lighten the mortality of infants on the very threshold of life.

The present laws allow thirty days for the registration of a death, and require that, if a body be buried without an order from the registrar, notice shall be given to him of such burial, but only within two months. No medical certificate of cause of death is demanded.

**Colonial Medical Reports.—No. 8.—Natal** (*continued*).

It is obtrusively plain that these lax provisions will admit of a person dying of violence, poison, or any other cause, and being buried without any inquiry. Deaths are now registered as due to such causes as "pain in belly," "cramp in the inside," &c., and there is nothing to show that any such death has not been caused by irritant poisoning.

Fortunately some of the defects of the registration laws are corrected in the towns by by-laws, under which a medical certificate of cause of death must be presented at the time of burial.

*Births.*

*Europeans.*—2,694 births were registered, equivalent to 27·23 per 1,000 living.

BIRTHS REGISTERED IN EIGHT YEARS.

| | 1902 | 1903 | 1904 | 1905 | 1906 | 1907 | 1908 | 1909 |
|---|---|---|---|---|---|---|---|---|
| Number .. | 3,086 | 2,700 | 3,156 | 3,111 | 3,110 | 2,840 | 2,792 | 2,694 |
| Per 1,000 living | * | †26·6 | 31·1 | 30·7 | 30·6 | 28·6 | 27·9 | 27·2 |
| Birth-rate— England and Wales | 28·5 | 28·4 | 27·9 | 27·2 | 27·1 | 26·3 | 26·5 | 25·6 |

* Population not known.
† Calculated on Census Population in 1904.

BIRTH-RATES IN SOME BRITISH STATES AND COLONIES, 1908.

| | |
|---|---|
| United Kingdom .. .. .. .. | 26·3 |
| England and Wales .. .. .. .. | 26·5 |
| Scotland .. .. .. .. .. | 27·2 |
| Ireland .. .. .. .. .. | 23·3 |
| New South Wales .. .. .. .. | 26·8 |
| Victoria .. .. .. .. .. | 24·6 |
| Queensland .. .. .. .. .. | 26·7 |
| South Australia .. .. .. .. | 24·7 |
| West Australia .. .. .. .. | 28·9 |
| Tasmania .. .. .. .. .. | 30·8 |
| New Zealand .. .. .. .. .. | 27·4 |

Although Natal compares favourably with most of the other States of which the rates are quoted, the low and diminishing birth-rate is highly unsatisfactory, especially as the sex distribution of the people is more favourable to a high birth-rate than it was six years ago.

The distribution of births is shown in the following table:—

EUROPEAN BIRTHS.

| | Estimated population | Births | Per 1,000 living |
|---|---|---|---|
| Colony .. .. .. | 98,934 | 2,694 | 27·23 |
| Urban populations .. | 52,189 | 1,547 | 29·64 |
| Rural population .. | 46,745 | 1,147 | 24·53 |
| Maritzburg .. .. | 13,853 | 429 | 30·96 |
| Durban .. .. | 29,287 | 844 | 28·81 |
| Other towns .. .. | 9,049 | 274 | 30·27 |

The disparity between the rate in urban and rural populations is fallacious, and due to the fact that country residents go to the towns for accouchement, and that the births are registered in the towns. This points to another defect in the registration laws, under which there is no obligation on the part of the person registering to state domicile of the parents, and there is no space in the prescribed schedule form for such entry. The address given is generally the place in which the child was born.

*Indian Immigrants.*—3,658 births were registered compared with 3,432 in 1908. The rate was 35·20 per 1,000 living, as against 32·9, 29·6, 27, and 33 in 1908-7-6-5 respectively. The birth-rate was adversely affected by the incidence of malarial fever in 1906-7. This class is less favourably situated than Europeans for a high birth-rate, there being fewer women of child-bearing age. In fact, considering the constitution of this part of the population, the birth-rate is relatively high, and is equivalent at least to 40 per 1,000 in Europeans.

*Deaths.*

All deaths of persons not domiciled in Natal have been eliminated, but no information has been received of the death in any other part of South Africa or elsewhere, of any person belonging to Natal.

| | 1909. |
|---|---|
| European .. .. .. .. .. | 806 |
| Indian immigrants .. .. .. .. | 1,672 |
| European and Indian immigrants together | 2,478 |
| Natives .. .. .. .. .. .. | — |

*Europeans.—Distribution of Deaths*, 1909.

| | Estimated population | Deaths | Crude rate per 1,000 living |
|---|---|---|---|
| Colony .. .. | 98,934 | 806 | 8·14 |
| Urban populations .. | 52,189 | 434 | 8·32 |
| Rural population .. | 46,745 | 372 | 7·95 |
| Maritzburg .. .. | 13,853 | 136 | 9·81 |
| Durban .. .. | 29,287 | 218 | 7·44 |
| Other Towns .. .. | 9,049 | 80 | 8·84 |

Death-rates from all causes in different parts of the Colony:—

| | 1909. |
|---|---|
| Urban populations .. .. .. .. | 8·32 |
| Rural population .. .. .. .. | 7·95 |
| Maritzburg .. .. .. .. .. | 9·81 |
| Durban .. .. .. .. .. | 7·44 |
| Other towns .. .. .. .. .. | 8·84 |

Death-rates in some British States and Colonies, 1908:—

| | |
|---|---|
| United Kingdom .. .. .. .. | 15·1 |
| England and Wales .. .. .. .. | 14·7 |
| Scotland .. .. .. .. .. | 16·1 |
| Ireland .. .. .. .. .. .. | 17·6 |
| New South Wales .. .. .. .. | 10·1 |
| Victoria .. .. .. .. .. | 12·5 |
| Queensland .. .. .. .. .. | 10·2 |
| South Australia .. .. .. .. | 9·7 |
| West Australia .. .. .. .. | 10·7 |
| Tasmania .. .. .. .. .. | 11·7 |
| New Zealand .. .. .. .. .. | 9·5 |

The death-rate, practically 8 to 1,000, is lower than any hitherto recorded in Natal. The advantage was almost confined to the two large towns, of which Maritzburg still maintains its unenviable lead, due doubtless to absence of sewerage and lack of proper sanitary supervision. The death-rate of the smaller urban communities is higher than last year, but as the total population is no more than 9,000, this has

no great significance, while the low death-rate of rural communities for some years, and particularly in 1907 and 1908, leaves little room for further decrease.

*Europeans.*—Total deaths registered fall short of the number for 1908 by 79, or 9 per cent., and of the average of the preceding five years of 181, or 18 per cent. The population in the time has fallen a little over 3 per cent.

Variation in age periods at which deaths occurred in the past six years, shows an increase or decrease on the numbers registered in 1904 :—

| Age period—years | 1904 | 1905 | 1906 | 1907 | 1908 | 1909 |
|---|---|---|---|---|---|---|
| 0 | 272 | − 34 | − 29 | − 74 | − 58 | − 119 |
| 1 | 101 | + 7 | + 7 | + 11 | + 9 | − 29 |
| 5 | 26 | + 2 | − 13 | + 5 | − 7 | − 9 |
| 10 | 16 | − 2 | − 1 | | + 3 | + 10 |
| 15 | 27 | − 10 | − 6 | − 12 | − 1 | − 4 |
| 20 | 63 | − 36 | − 27 | − 29 | − 38 | − 34 |
| 25 | 149 | − 41 | − 11 | − 55 | − 62 | − 74 |
| 35 | 110 | − 4 | − 6 | − 10 | − 18 | − 14 |
| 45 | 104 | − 1 | + 10 | − 1 | − 31 | − 25 |
| 55 | 89 | − 19 | + 5 | − 5 | − 9 | − 11 |
| 65 | 80 | − 18 | + 8 | − 5 | − 5 | + 9 |
| 75 | 52 | | + 3 | + 13 | − 5 | + 3 |
| 85 | 15 | + 8 | + 10 | − 3 | + 3 | − 1 |
| All ages | 1,104 | − 148 | − 50 | − 165 | − 219 | − 298 |

Change in incidence of certain fatal diseases as compared with 1904 :—

| | 1904 | 1905 | 1906 | 1907 | 1908 | 1909 |
|---|---|---|---|---|---|---|
| Small-pox .. .. | 24 | − 24 | − 24 | − 24 | − 24 | − 24 |
| Measles .. .. | 1 | + 9 | + 2 | + 2 | + 23 | + 5 |
| Influenza .. .. | 9 | − 1 | − 3 | + 4 | − 4 | − 4 |
| Whooping cough .. | 4 | + 8 | + 4 | − 2 | + 19 | + 2 |
| Diphtheria .. .. | 12 | + 9 | − 1 | + 1 | − 6 | + 5 |
| Enteric fever .. | 58 | − 19 | − 21 | − 31 | − 38 | − 39 |
| Diarrhœa, dysentery, and enteritis | 164 | − 42 | − 25 | − 48 | − 71 | − 89 |
| Malarial fever .. | 6 | + 21 | + 75 | + 23 | + 2 | + 10 |
| Tuberculosis .. | 97 | − 34 | − 8 | − 15 | − 42 | − 37 |
| Cancer .. .. | 49 | − 15 | − 4 | + 8 | + 4 | + 15 |
| Premature birth .. | 13 | + 3 | + 14 | + 15 | + 9 | − 1 |
| Developmental diseases | 60 | − 19 | − 22 | − 32 | − 25 | − 40 |
| Old age .. .. | 40 | − 8 | + 6 | + 1 | − 2 | − 10 |
| Meningitis .. .. | 19 | − 6 | − 15 | − 11 | − 12 | − 15 |
| Pneumonia .. .. | 55 | + 8 | + 12 | − 7 | + 9 | − 20 |

The notable features of the fall in the death-rate, as shown in the two foregoing tables, are that it has been, except for an interruption resulting from the epidemic of malarial fever in 1906, progressive and continuous, and that 35 per cent. of the lives saved have been of children under one year. There is shown a saving of 314 infant lives, of which about 90 may be attributed to the birth-rate being less year by year, and consequently to there being fewer infants living among whom deaths could occur. Practically the whole of these savings have been effected, and in about equal proportion, by improvement in two disease groups, namely, "diarrhœal diseases" and "developmental disorders," that is to say, vague and indeterminate, though fatal conditions, manifested as debility at the time of birth or in early infancy, and commonly resulting from bad nutrition.

Of the rest, the diminution is chiefly in the earlier years of adult life, and in the diseases enteric fever and tuberculosis, which fall most heavily on persons of those years. This diminution is, in considerable part, attributable to the reduction of the proportion of persons of that age, owing to emigration. The effect of that, however, is to increase the proportion of persons of more advanced years and shorter expectation of life, and the alteration enhances the satisfactory condition demonstrated by the figures.

In 1904 the death-rate was 10·89, and the population favourably constituted for a low mortality; in 1909 the population was less favourably constituted, but the death-rate was but a little over 8·0 per 1,000 living. The advantage has been principally to the towns, a reduction in rate of 40 per cent. in Durban, and 39 per cent. in Maritzburg, but of rather less than 5 per cent. in other parts as compared with rates of 1904. Seeing, however, that in 1904 the rate for places outside the towns was but 8·5 per 1,000, there was little room for reduction.

*Indian Immigrants.*—Total deaths registered in the year 1909 amounted to 1,687, of which 15 having occurred prior to the *beginning* of the year 1908 are included in the table.

The rate amounted to scarcely more than 16 per 1,000 living, far lower than any previously recorded since 1901. The number of Indian immigrants is practically the same as it was in 1908, and there has been an actual reduction in the number of deaths of 275, as against the number registered in 1908.

The rate in 1904 was 18·95, and the reduction has the value of 16 per cent.; but whereas in Europeans one-half of the total savings was shown to have been at ages below five years, in Indian immigrants the advantage has been entirely to adults or persons over fifteen years while the death-rate of children has increased considerably. According to the Protector's registers the number of adults has increased 19 per cent., and of children 13 per cent., while the total deaths registered of the former have decreased 15 per cent., and the latter have *increased* 40 per cent.

Estimated on the Protector's figures, the death-rate from all causes of adults was reduced by 29 per cent., but that of children increased by 22 per cent. If children had shared the advantage equally with adults, the number of deaths occurring in persons under 15 years would have been 468 only, whereas 803 were actually registered. Allowing for increase in population, there were registered 144 more deaths of children than there would have been had the death-rate remained as it was in 1904.

One-sixth of the excess is attributed to malarial fever; more than one-third to wasting diseases and convulsions; one-sixth to pneumonia, and the rest in about equal amounts to syphilis, premature birth, and disease of the kidneys. Nearly all these deaths were of children under five years.

It is also notable that the death-rate of adults in the group "free" which, in 1904, was a good deal

higher than that of "indentured" adults, was in 1909 approximately equal. The records which are kept in the Protector's office, however, are not drawn up in a manner satisfactory for use in vital statistics. The death records are kept as of persons over and under 15 years, while the population is divided into "adults" and "children." A male becomes an adult at 16 years, and a female at 13 years. Thus the age groups of the population and of registered deaths do not accurately correspond. An uncertain margin of error is thus introduced which prohibits anything but a very general use of the available figures.

Nearly every heading shows a lower mortality, and in a few where it is higher, the increase is insignificant.

INFANTILE MORTALITY.—SHOWING DEATHS AND DEATH-RATES UNDER ONE YEAR.

| | Total births | Total deaths | Per 1,000 births | Deaths from diarrhœal diseases | Per 1,000 births |
|---|---|---|---|---|---|
| Europeans— | | | | | |
| Colony .. .. .. | 2,694 | 153 | 56·79 | 43 | 15·96 |
| Maritzburg and Durban | 1,274 | 68 | 53·41 | 24 | 18·85 |
| Elsewhere .. .. | 1,421 | 85 | 59·81 | 19 | 13·37 |
| Indian immigrants— | | | | | |
| Colony .. .. .. | 3,658 | 431 | 117·82 | 50 | 13·66 |

to presence of large numbers of refugees and burghers from the Transvaal. For the seven years, 1903-9, the mortality of infants from diarrhœa per 1,000 births has been in Durban 34, Pietermaritzburg 46; that is, the rate has been 35 per cent. higher in the latter.

An interesting point in the comparative mortality of infants in the two towns from diarrhœal disease is displayed in the chart showing the proportion of the total deaths which occurred in each of thirteen equal periods of four weeks Not only is there a difference in the times of the maximum and minimum, but whereas in Pietermaritzburg, of a total of 166, no death occurred in any one of the seven years, between July 15 and August 12, and in the period between May 20 and August 12 only two deaths occurred in the seven years, in Durban the lowest number is found in March, namely, six of a total of 237.

In Pietermaritzburg, in the five months of maximum incidence, over 80 per cent. of the deaths came about, and in the four months of lowest incidence less than 4 per cent., while in Durban only 55 per cent. occurred in the former, and nearly 18 per cent. in the latter.

The minimum in Maritzburg falls in mid-winter when weather is crisp, dry and still, with occasional frosts at night, but the maximum, falling in October,

UNDER ONE YEAR.—DEATHS PER 1,000 BIRTHS IN PAST EIGHT YEARS.

| | 1902 | 1903 | 1904 | 1905 | 1906 | 1907 | 1908 | 1909 |
|---|---|---|---|---|---|---|---|---|
| Europeans— | | | | | | | | |
| All causes.. .. .. .. | 76·7 | 113·33 | 86·81 | 76·50 | 78·13 | 69·71 | 76·64 | 56·79 |
| Diarrhœal diseases .. .. | 27·2 | 42·96 | 31·68 | 24·10 | 29·58 | 24·64 | 21·13 | 15·96 |
| *Indian immigrants— | | | | | | | | |
| All causes.. .. .. .. | — | — | — | — | — | 120·83 | 127·33 | 117·82 |
| Diarrhœal diseases .. .. | — | — | — | — | — | 14·29 | 17·19 | 13·66 |

* Information prior to 1907 not available.

*Europeans.*—There were registered 63 fewer deaths than last year, and the rate was considerably lower than any previously recorded. A particularly satisfactory feature is the diminution in deaths from diarrhœal diseases.

In the report for the year 1908, it was noted that for the preceding five years the death-rate from enteric fever and diarrhœal diseases at all ages was considerably higher in the town of Pietermaritzburg than in Durban.

In the past six years the rate from dysentery, diarrhœa and enteric at all ages, calculated on the mean of the population as ascertained by census in Pietermaritzburg in 1904 and 1909, and in Durban in 1904, 1907, and 1909, was in the ratio Durban 100, Pietermaritzburg 128. That is to say, the rate was 28 per cent. higher in the latter.

It is not possible to ascertain the rate for a more extended period, because the population was not known, although the records have been kept since 1902. In calculating the infant mortality, it is undesirable to include the year 1902, because the character of the population was quite abnormal owing

does not correspond to the maximum atmospheric temperature, which is generally highest in January. The deaths from diarrhœa begin to be notable in September, when the mean temperature begins to show a decided upward tendency, the rainfall is slight, and high winds are common. In October, when the greatest number of deaths occur, there is a fair rainfall, a less number of days on which the wind is high, and a further increase in temperature, particularly in the minimum. In this month, too, as a matter of general observation, though not demonstrated by any direct evidence, flies are most numerous and troublesome.

After October, the deaths decline steadily in number, despite the increase in the mean temperature. In the latter months, however, there is much less wind, generally a much higher rainfall, and in consequence, probably the latter, flies are less obtrusive.

In Durban the chart indicates in more general terms that there is about double the tendency to diarrhœa in the hotter months. There is also a rise in the latter part of May and beginning of June. This rise is observed in five years out of the seven.

There is considerable difference in the character of the climate of the two towns. Durban is humid nearly all the year. The maximum temperature is on the whole rather lower than that of Maritzburg, but the minimum is from 50 to 10° F. higher. Consequently there is no time of immunity from conditions favourable to diarrhœal disorder.

It is possible that "climatic conditions," particularly hot winds with dust storms, may place Maritzburg at a little disadvantage as compared with Durban in the early summer, but this is much more than counterbalanced by the advantages enjoyed in the cold months, but for which the death-rate in the former would be much higher than it actually is.

The death-rate from diarrhœal disease ought to be much lower in Pietermaritzburg than in Durban. It has been, as the average of the term of years, 35 per cent. higher. The difference is a well-marked instance of the effect of good and bad sanitary administion respectively. For several years a considerable portion of Durban has been served with a water carriage system of sewerage, and now almost the whole town is so served; in Pietermaritzburg pail closets only are in use, emptied twice, and in the outlying parts only once, a week. In Durban the average staff of sanitary inspectors has been one chief inspector and ten inspectors; in Pietermaritzburg one inspector and one sub-inspector. During the year 1909 the office of Inspector in Pietermaritzburg was merged in that of Borough Engineer. The population of Durban is double that of Pietermaritzburg; for purposes of inspection there are ten officers in the former and one in the latter; that is to say, the one inspector in Pietermaritzburg has to perform five times the work of an inspector in Durban.

*Indian Immigrants.*—The death-rate from all causes is rather more than double that of European, the diarrhœal death-rate being 2 per 1,000 births lower. Both rates, however, are considerably lower than in 1908. It is thus evident that generally conditions were favourable to a low infantile mortality in 1909.

In each race alike—Europeans and Indian immigrants—85 per cent. of all deaths were attributed to one or other of nine groups of causes. In Europeans diarrhœa has figured so prominently as to account for 30 per cent. of deaths, but only 12 per cent. of the deaths of Indian immigrants are attributed to it. On the other hand, approximately 30 per cent. of the latter are attributed to debility and congenital defects, against 18 per cent. of the former. It is probable, however, that the term of pregnancy expired at time of the birth is less frequently ascertained in the case of Indian immigrants, and so premature birth should be linked with debility, in which case the mortality of Indian immigrants from such causes is not much higher. The mortality of the latter, again, is greater from all infective ailments except measles and whooping cough. In respect to these causes of death, again it is probable that the diagnosis is less exact in Indian immigrants; the children come under medical observation later in illness, and the lack of a common language hinders the mother from tendering, and the practitioner from eliciting, much detailed history of the illness. It may well be that deaths from measles and whooping cough are attributed to the terminal illness, such as bronchitis and pneumonia, the figures for which are thereby increased.

Nearly 7 per cent. of Europeans, and over 12 per cent. of Indian immigrants die in the first year of life. For every ten white infants dying in the first three months, twenty-five Indians die, but in the remainder of the first year the chances are nearly equal, namely, 10 and 12½.

The cause of the inequality in the first three months is mainly in such ill-defined conditions as "debility," &c., that is to say, that a far higher proportion are born without the strength to struggle through the early days of life, but, having once survived that, the Indian children can nearly hold their own with the European. This is due to the fact that mothers work, and to ignorance, and customs born of prejudice.

Twice as many Indians die in the first month of diarrhœa, but are at advantage in practically every other period. With environment and circumstance all against them, one would expect a much higher rate. The only explanation is to be found in the practically universal custom in Indians of natural feeding of infants, of the advantages of which the Tables afford a very useful demonstration.

Mortality per cent. of cases of enteric fever in the Colony:—

| 1902 | 1903 | 1904 | 1905 | 1906 | 1907 | 1908 | 1909 |
|---|---|---|---|---|---|---|---|
| 9·91 | 9·12 | 11·24 | 14·88 | 15·10 | 10·0 | 12·42 | 11·81 |

Excepting for the outbreak at Cedara, and a number of cases at Natal Police Headquarters in Pietermaritzburg, there was nothing of the character of an epidemic. In the year 1908 there occurred 58 cases in 19 Divisions out of 46, the largest number in any one being seven; in 1909 there were recorded 69 cases in 27 divisions, the largest being 12 in each of two divisions, the one containing the Agricultural College, and the other the several coal mines. The incidence on the latter was small relatively to past years, but double that of 1908.

Ten white persons were reported as suffering from enteric fever, contracted on the property of the Agricultural College, eight resident in the main building, and two in other adjoining buildings.

Unfortunately one of the sufferers, a student at the college, died.

The total number of white persons on the farm was about 60, of whom 35 took meals in the College mess-room.

There is a reasonable presumption that a coloured person also suffered from enteric fever, from whom infection was probably communicated to the white persons.

The following appear to have been the dates of commencement of illness:—

| | | | |
|---|---|---|---|
| I. | Oct. 23 | A. | |
| II. | Nov. 19 | C. | |
| III. | ,, 24 | C. | |
| IV. | ,, 29 | C. | Resident at Weenen Farm at the time. |
| V. | ,, 29 | B. | |
| VI. | Dec. 17 | C. | |
| VII. | ,, 17 | C. | After leaving Farm. |
| VIII. | ,, 17 | C. | ,, ,, ,, |
| IX. | ,, 25 | C. | ,, ,, ,, |
| X. | Jan. 1 | C. | |

C. = College.
A. B. = Detached houses.

**Colonial Medical Reports.—No. 8.—Natal** (*continued*).

An investigation was commenced by the health officer for the colony on December 2. The fact that cases were confined to persons resident in, or in the near vicinity of the college, suggested an origin, to which the rest of the residents were not exposed. In addition to this it is scarcely possible for the water supply to be polluted. The water is taken from small streams, having their origin in springs on the lower level of the hills; the watershed from which surface water gains access to these streams is small, and sharply defined by the crest of the hills, which form almost a semi-circle. There is no human habitation on the watershed; neither cattle, sheep, nor horses are grazed there. It is patrolled by a forest guard who arrests trespassers. None, however, has been found for some considerable time.

If milk infected at the dairy had been the vehicle, it is practically certain that some persons living elsewhere than in these three houses would have been affected.

Attention was therefore given to the question whether any person in the college establishment had recently suffered any illness which might have been unrecognized enteric fever, and from whom infection of all the other persons might have been derived.

It was ascertained that an Indian house and table servant of the college had recently been absent from his duties. On closer inquiry it was ascertained that the boy became ill, or complained of illness, on October 12; that on October 16 he applied for leave to go to his home; and that he returned somewhere about November 7 to 10.

During his absence he suffered, according to his own statement, from some indefinite but not serious illness, which, however, so reduced his strength that, when he did return, he declared himself not strong enough to do any work. It appears that he was not actually engaged again in recognized duties at the College till December 1; but, seeing that his father and other fellow servants were working there, and that he was living in quarters not 200 yards off, there is no doubt that he did frequent the kitchen, and occasionally helped in the work. Similarly, although it was advised that he should not be permitted to do any work at the College after the inquiry commenced, there was nothing to prevent him being in the building and helping until his final removal on December 8.

The agglutinative action of this Indian's blood was investigated by the bacteriologist, who reported that in dilution, 1-40, it agglutinated *Bacillus typhosus* in ten minutes. It was accordingly concluded that the boy's illness had been enteric fever, and that he was the probable source of the other cases. The origin of his illness cannot be conjectured. He may have been, and probably was, infected outside the property. Specimens of his urine and fæces were subjected to examination by the bacteriologist, but the *B. typhosus* was not found. This, however, cannot be taken to indicate that he was not infective up to the time of his leaving the college, because he might not have been discharging bacilli on the particular day, or they might have been so few as not to be detected.

Recent researches on "Typhoid Carriers," published by the Army Medical Department, show that an infective person may cease to discharge typhoid bacilli for some days, and that then again the organisms may be detected in the fæces, and that this alternation may continue for a very long period.

Assuming that this Indian was a possible source of infection, that is, assuming that the illness was enteric fever, could he have infected all the cases? He was probably discharging infected matter as early as October 12. The illness of No. 1 began about October 23. In point of time only, the boy might have been the source. But he worked in the College with which No. 1 had no domestic connection. The quarters in which the boy lived, and the bucket closet provided for servants, were actually nearer to the residence of No. 1 than to the College. The closet was a temporary structure, consequent on a fire, and in bad order, while flies were, as nearly always happens on farms at the time of year, abundant. The boy returned about November 7 to 10, and remained till December 8. He might then easily have infected II., III., IV., VI., VII., VIII., IX.

In regard to No. X., although he did not actually report sick till January 7, it appears that he was very unwell in the New Year holidays, and, although rather longer than usual, twenty-three or twenty-four days is not outside the range of the period of incubation; or, again, the Indian may have deposited infected matter in some unauthorized place, which, of course, would continue to be infectious. This person might also have been infected elsewhere than on the property. He was absent in Pietermaritzburg in the Christmas holidays.

On receipt of information of the illness of No. X,, in view of the rather long interval after the removal of this Indian servant, samples of fæces and urine of the cook, and of one other person, to whom circumstances pointed as being a possible agency of infection. were obtained and examined by the bacteriologist, The tvphoid bacillus was not isolated in either case.

As to case V., it appears probable that the infection was derived indirectly from I. The residence of V. is some little distance from the College in the opposite direction to I. and the Indian quarters, and it is unlikely that infective matter would be carried so far. But the person visited the house of I. during illness of the latter, although not seeing him, and took tea in the house "about a month" before commencement of illness.

Cases I. and V. were treated in their own residences. Cases II., III., IV., VI. were removed to Pietermaritzburg on the first sign of illness; and Case X. on reporting sick; VII., VIII., IX. were taken ill after leaving.

The conclusion, therefore, is that nine of the ten persons were infected with matter derived from the Indian, and one from material from the first case of the series.

Thus the probable cause of this outbreak and of that of 1907 were similar, namely, the presence in the

establishment of a typhoid carrier. General evidence certainly pointed to this in 1907, although in that instance no examination of excreta was made, while in 1909 the result of examinations was negative. In neither instance was proof of the hypothesis forthcoming.

It has been advised that no new servants should be engaged for the College or dairy until the history of the person has been inquired into, and the agglutinative effect of his blood serum upon *Bacillus typhosus* ascertained, and that all servants should be submitted to medical inspection once a fortnight. This will do much to eliminate the possibility of the engagement of any person who has recently suffered from enteric fever, and to insure the recognition of the nature of any illness which may occur. It has been decided to instal a water carriage system for the sewage of the Agricultural College and adjoining buildings, and probably for all the farm, excepting two remote and isolated houses, and to construct suitable works for its purification. When these are completed there will be no opportunity for flies to gain access to excrement. There is always some difficulty in inducing coloured servants to use privies and urinals, but the difficulty is far less when suitable cleanly water conveniences are provided.

Nine cases of enteric fever were notified from Headquarters of the Natal Police, of which one occurred in September, one in November, and seven in December. Six of the December cases occurred in the first fortnight, in which period also were notified three cases stationed elsewhere, but who had attended with many others from various parts, a general parade in Pietermaritzburg on November 26. All of these except one, who was a warder at the Central Gaol, attended the parade, and it appears probable that all received infection at that time. It is, however, by no means apparent that there could have been any connection between the parade and the drills held in the preceding two days and the outbreak, but it is probable that there was opportunity for infection at the barracks at that time. There is some difficulty in accepting this, because three of the number were officers, of whom two resided in Pietermaritzburg, and one up-country, having come in for two days for the parade. Inquiry was made, and it appears that two of the officers occasionally had a cup of tea from the general mess about the time of the parade, but no food, while the third could not recollect having had anything in the way of food or drink at all.

Twelve cases of enteric fever were notified as having occurred in Dundee District. Seven cases occurred at collieries, and three at farms. There were two groups each of three cases in which there was a connection, and in a third instance the date of illness of two persons was synchronous. Eight of the persons attacked were persons under 12 years of age. The conditions on mining properties are conducive to the propagation of enteric fever; there is at each a large number of native and Indian labourers, and sanitary supervision is seldom really good. It is, on the whole, surprising that more cases do not occur.

*Diphtheria (Europeans).*—111 cases were notified, of which one-half was in the Borough of Durban. On the other hand, of seventeen deaths registered, only two occurred in Durban, but ten in rural districts where less than one-quarter, viz., twenty-five, of the cases were notified. This disparity is mainly due to better facilities for medical treatment in Durban, and explicable in less part by the fact that in the more distant parts of the country only severe cases come under medical treatment. Diphtheria is, fortunately, a disease which is amenable to serum treatment, but the success depends on early commencement; the earlier the treatment is begun the more sure is the prospect of recovery.

*Scarlet Fever.*—104 cases were notified as against 30 in 1908, and an average of 73 in the preceding six years. Three deaths were attributed to this disease, which was assigned as the cause of one death in each of the years 1902-3-4, but of no death since. One of the persons who died in 1909 succumbed to an acute toxic attack of unusual severity, while in the case of the other two, the immediate cause of death was acute inflammation of the kidneys.

Scarlet fever has been for many years in Natal, and, as I understood, throughout South Africa, a very mild disorder. The illness has been so slight, and a fatal termination so rare, that not only the people, but even the medical practitioners have treated it with far less respect than it is entitled to. In the year 1909, however, it appears that an unusually severe type of the disease prevailed in parts of the Transvaal. The history of scarlet fever in Great Britain shows that the severity varies greatly over periods of years. At one period it has been of little importance, in a succeeding period it has appeared largely in the death registers, and in a succeeding period, again, it has once more been manifested by mild symptoms. The climatic, and in most parts, too, the social, advantages of the people of South Africa will protect them from a visitation of scarlet fever of severity comparable to that which prevails from time to time in the slums of the great cities of Europe, but it is not unlikely that in the early future it will manifest sufficient severity to cause not only more attention to be paid to the illness as such, but also to produce a demand by the people for some greater degree of protection from the spread of infection.

Twenty-nine of sixty-four cases, which occurred in rural areas, were notified from a single institution, Hilton College. There was, fortunately, no death. Many boys also suffered from sore throat, generally causing little illness, but which certainly was a manifestation of infection with scarlet fever. The school re-opened after the winter holidays on August 4. The first case occurred on the 16th, the next on the 17th. The boys were immediately isolated on declaration of illness, and they were not, therefore, at least it is improbable that they were, the cause of subsequent cases. Fourteen more occurred in August and thirteen in September. No information was received by the Department of the occurrence till September 1. By that time it was evident that infectious material was widely disseminated, and was not confined to particular forms or

dormitories. The Health Officer for the colony visited the school with the Medical Officer, and, *inter alia*, it was strongly recommended that all boys known to have suffered from sore throat should be isolated for a period. After this was done the number of cases quickly diminished, but the epidemic was not finally extinguished until the majority of the boys was removed from the College buildings and put under canvas for a few days. The school buildings, linen, &c., were thoroughly disinfected by the school authorities, and no cases occurred after the end of September. The school management was placed in a position of great difficulty through lack of suitable accommodation for effective isolation, especially of those whose illness was slight, and it coped with the difficulty very creditably.

The original case was not detected, nor the source of the outbreak. The circumstances, however, point to the presence among the boys returned from holiday, of one (perhaps more) who, after some very mild manifestation of illness, such as a sore throat, with or without a transient rash, easily overlooked, really due to scarlet fever, was in a condition to infect others.

There was a number of such cases in the course of the epidemic, which played a part in the dissemination of the infection.

The parents of the children are very greatly to blame for not giving greater attention to the nature of illness in their children, and in their coloured servants, and also, in some cases, for their callous disregard of the interests of others. Instance of both come to the knowledge of this Department from time to time. In one instance last year, a medical practitioner was sent for to a farmhouse to see a boy who was very ill. He found him to be suffering from kidney disease, which proved fatal a few hours later. On inquiry it was found that this boy and five other children had been ill with sore throat and a red rash. No doctor had been consulted, and the infectious character of the disease was not recognized.

The callousness of some parents is shown by the following instance, in which, however, it happens that the disease was chicken-pox and not scarlet fever. At a certain school for girls, parents are required to sign and send to the management a statement on a printed form that the child has not been exposed to infection of any infectious disease. A few days after the opening of the school a girl manifested evidence of chicken-pox, and then volunteered the statement that the Indian cook at her home had had it. And yet the father had signed the statement!

The following incidents illustrate very clearly the manner in which infection of scarlet fever and other diseases is spread. St. Annes' College for Girls, Hilton Road, resumed after the winter holidays on August 4. On August 8 one girl was ill with scarlet fever, and on the 15th a second girl, who was much in contact with the first. There were some cases of sore throat, but no other recognized cases of scarlet fever till two girls were taken ill on August 29.

The source of infection was traced to the district of Vryheid. Case No. 1 had been there staying from the end of June till August 1. A Native woman used to go to the house each week to do the washing. On July 16 the woman went as usual, but complained of sore throat and feeling of illness and went home. She returned to the duties as usual on the following week. This native woman resided on the farm, where six cases, as above referred to, occurred somewhere about the second week in August, while in a third house, which she visited, one of the children suffered from scarlet fever.

There is no reasonable room to doubt that the coloured population is largely concerned in the spread of all infectious disease.

The accommodation for the isolation of cases of infectious disease was inadequate, and the principal was desirous to close the school for a short period. In the circumstances that few cases had occurred this proposal was approved by the health officer for the Colony, subject to adequate precautions being taken to prevent any contact with the sick for ten days, and to prevent any one not in good health at the time from leaving. Detailed advice was given, but apparently inadequate attention was paid to it, and one household epidemic resulted from the breaking up of the school, which is epidemiologically interesting. The salient facts are:—

(1) On September 9 "A" leaves Durban by train, and meets at South Coast Junction "B," who comes from up-country. They travel together to Park Rynie and live there together.

(2) On September 17 "C" and "D" leave St. Annes and travel to Park Rynie and there join "A" and "B."

On September 16 "C's" throat was sore and it was giving considerable discomfort on arrival at Park Rynie.

(3) On September 20 "A" taken ill and dies on 21st of what appears to be acute toxic scarlet fever.

(4) On September 21 "B" taken ill and exhibits a scarlet fever rash on 22nd.

(5) On September 24 "D" is ill with scarlet fever.

It is interesting to note that "D," who was the most exposed, was the last of the series to be attacked.

*Diarrhœa, Dysentery, and Enteritis.*—The reduction from 1902 to 1909 is equal to 70 per cent. in Europeans, and 50 per cent. in Indians; in both groups it is largely attributable to improvement in sanitary conditions resulting from better supervision and administration. In Europeans the fall has been progressive and continuous, with an interruption in 1906, which was due to the adverse influence of malarial fever. This influence is much more heavily exhibited in the Indian population, which is more exposed to malarial influences. There was indeed practically no improvement in the Indian mortality from intestinal irritation until 1908, and the most of it is shown in 1909, in which year orders to provide suitable latrines for Indian employees were served on all except the very small employers, and were enforced to the extent feasible with the very inadequate establishment of the Department, which has received a very limited assist-

ance from employers. Some of the large employers of labour have appointed a white man to secure that sick Indians receive immediate and suitable treatment when ill, and to prevent their evading it, and to direct the scavenging of the surroundings of the barracks. Where this work has been properly carried out great advantage has resulted. Some employers, however, are too negligent or too perverse to render anything but a very impassive assistance to the Department. The only remedy for such people is a free employment of the aid of the law, but even that is ineffectual. The maximum penalty for an offence indictable in the court of a magistrate is a fine of £50; the ordinary penalty is £3 to £5, an occasional punishment £10, which is of course nothing to a Company, especially when the defendant feels no sense of shame at the position to which he knowingly brings himself.

*Malarial Fever.*—The number of deaths registered shows an increase in Europeans from 8 to 16. This is entirely due to the fact that there was a severe incidence upon the people in the districts of Ngotshe, Vryheid and Paulpietersburg, in which 10 of the 16 deaths occurred.

There are no Indians in these parts, and consequently the effect is not reflected in the death-rate of Indian immigrants, which further declined from ·77 to ·52 per 1,000. Nearly all the deaths in the latter group were of free Indians, and in more than half the cause was not certified by a medical practitioner. It is probable that several of these were not due to malarial fever at all. Very few newly infected cases were met with during the year, south of the Tugela, except in small areas unfavourably situated, and the majority of the deceased died of the effects of chronic untreated malarial fever. The returns of the hospitals of the Indian Immigration Trust Board show 205 cases treated and no deaths, as compared with 253 cases, of which six proved fatal, in 1908. The ratio to all admissions, however, was practically the same in both years, approximately 3·3 per cent., but in 1909, at the only hospital north of the Tugela, the ratio was 33 per cent. of admissions, whereas it did not exceed three and a fraction in any hospital south of the river.

In the year 1905 very nearly half of all the deaths in respect to which information was obtained, was of persons resident less than three years, and more than one-fifth less than one year; but in 1909 only two of 31 were resident less than three years. This indicates that far fewer persons suffering from advanced consumption come to this country as a last hope, but on the other hand, it also indicates a greater incidence of phthisis on the normal population, which will require very close attention in the future.

In the year 1900 only 2½ per cent. of deaths were of persons of less than one year's residence, as against 5 per cent. in 1908, and 14 per cent. in 1907; 19 per cent. were of persons resident between one and three years, compared with 21 and 26 in the two preceding years. This is satisfactory as indicating that greater strictness is exercised in excluding from the country, or in sending out again on detection, persons affected with tuberculosis on arrival. The effect, however, is deceptive in respect to the death-rate of indentured Indians from this disease, because if the persons who have been returned to India had remained in the country some of them would have died, and thus the rate would have been raised. Even with this advantage the rate for indentured Indians fell very little. Although the rate for all Indians underwent considerable reduction, the gain lay almost entirely with the free.

The difference in the mean for the two groups is mainly a matter of age distribution, the officially recorded population of indentured Indians containing very few children indeed, because a child born to indentured parents is entered in the registers as "free." Beyond this, in practically all deaths of indentured people, the cause is certified by a medical officer, whereas the cause of death of many free men is not so certified, and there is a likelihood that deaths attributed to tuberculosis on the one group are assigned to various causes in the other.

The distribution of deaths from tuberculosis, and particularly from tuberculosis of the lungs, in indentured Indians has altered in the past two years. The number of deaths due to this disease registered in coal miners is less than half what it was in 1907, and the ratio to the total has fallen similarly, but the incidence on indentured Indians in the coastal area has increased; the absolute total of such increase is, however, not large, and may be due to accidental causes, and some difference in the medical certification. In 1907 a large number of persons suffering from phthisis was removed from the coal mining areas and most of them returned to India. The advantage to the death-rate has been both apparent and real—apparent in that the people who would have died there were no longer there to die, and real in that they certainly would have infected others, some of whom would have already perished.

The number of Colonial-born Indian immigrants who have died of pulmonary phthisis is very significant. According to the Protector's registers, about 24 per cent. of the people were born in Natal. In the past three years 18 per cent. of the deaths from phthisis have been of Natal born. So far as that alone goes, it appears to be an advantage to have been born in Natal. But this instance provides an apt illustration of the fallacy of comparing death-rates without corrections for age distribution in the different parts of the population. Unfortunately the records available for ascertaining these particulars in respect of Indian immigrants do not afford precise information, but a rough idea can be gleaned from the Annual Reports of the Protector. Indian immigration commenced in 1860 with very small numbers. In 1889 there were in Natal rather less than 4,000 Indians who were born in the Colony. As many of these were young children, a very moderate reckoning would be that in the aggregate a number equal to seven in every 1,000 have died in each of the succeeding seventeen years—that is, up to the middle of the period with which the table deals. That would account for nearly 500. At a very low estimate indeed another 500 have since left with parents.

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**37th Session. October-December, 1911.**

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*Chief Office*—SEAMEN'S HOSPITAL, GREENWICH, S.E.

**Colonial Medical Reports.—No 8.—Natal** (*continued*).

There cannot then be more than 3,000 Natal-born Indians over 20 years and less than 45 years of age. Of this small number 52 died of phthisis in the three years under consideration, being at the rate of 5·7 per 1,000 per annum. If the proportion of Indian immigrants at the several age periods is the same as it was at the time of the census in 1904 – and there is no reason for supposing that any great change has occurred—there were in the middle of 1908 nearly 54,000 Indian immigrants (including Natal born) of the age 20 to 45. The number of deaths of all Indian immigrants at those ages not born in Natal was 441, equivalent to a rate of 2·9 per 1,000 living per annum on persons not born in Natal. There is admittedly a considerable margin of probable error in the figures of population, but the error is certainly far short of the possibility of bringing these wide differences in rate to any degree of approximation. The figures, however, in the Natal-born group are too small to justify any particular inference, though suggesting that the occupations adopted by many of this class favour the acquisition of fatal tuberculosis.

The number of persons below the age of 20, reckoned in a similar manner, are nearly equal. Of 21,500 Natal born 55 died, and of 22,500 born in India 34 died, rates of 0·87 and 0·50 respectively.

*Ankylostomiasis and Ankylostoma Infection.*—Sixteen deaths of Indians were registered as resulting from ankylostomiasis, or disease resulting from the action of parasitic hookworms, as compared with 29 in 1908. This does not take into account any deaths which may have been caused by the presence of hookworms reducing the resisting power to other diseases. From the returns of the Indian Immigration Trust Board it appears that the percentage of the indentured Indian population discharging ova at the end of the year is very much less than was found at the beginning. This was stated to be over 60 per cent. at the commencement of the year, while in November and December it did not quite touch 15 per cent. of the cases examined, no alteration having been made in the standard of examination. In the gaols less than 10 per cent. of those examined were found to be infected, but the ratio varied in different gaols. Records were not kept showing the proportion of indentured and free.

In one gaol 62 natives were examined and 4 only found to be harbouring ankylostoma. These results, however, are not comparable with those obtained in Indians, because most of the persons were ill and were examined on that account. This and previously recorded examinations clearly indicate that the native is not generally infested with this parasite. This is a fact which must receive consideration. At present only a small number of natives live in circumstances favourable to the spread of ankylostoma infection; but as the country progresses it is inevitable that a greater number year by year will live in village conditions, and will be more and more exposed to infection.

During the year restriction was enforced on the allotment of newly arrived Indians. The conditions required were that if more than 6 per cent. of persons were found, by examination of two films prepared for microscopic inspection, to be discharging ova, the whole of the shipment should be subjected to examination, and those found to be infected treated repeatedly until no evidence of the continued presence of worms was discovered. The immigrants were treated with vermicidal remedies on one or more occasions before embarkation. Although two shipments only were able to satisfy the requirements of the department, the general results of the dosing were fairly satisfactory. Towards the close of the year the Indian Immigration Trust Board made urgent representations that the restrictions were seriously interfering with the possibility of recruiting the number of persons for whose labour there was demand, and were causing very heavy expense to the Board by reason of the detention of persons, and the cost resulting therefrom. After several meetings of the Health Officer for the Colony and Port Health Officer with representatives of the Trust Board, the Minister was advised by the Board of Health that the restrictions might without grave risk be reduced, if the Trust Board undertook that each infected person should receive two courses of suitable treatment at a week's interval, and also engaged itself to, as far as possible, secure the active co-operation of employers in improving the sanitary conditions of the surroundings of barracks. The restrictions were reduced accordingly, the department, however, reserving to itself the right to examine the excreta of 25 per cent. of the immigrants seven days after administration of the second treatment in the first shipment, and the first in subsequent shipments. It is presumed that much more care must have been exercised of late than in earlier instances in the administration of medicines, for the results as judged by the examination of excreta are very much more satisfactory. Indeed, if the like results had been attained in the early part of the year, the Board would have had no reason to complain of the conditions imposed.

The reduction in the number of persons showing evidence of infection in the coastal areas is attributable in part to the number who have been treated, and in greater part to improved sanitary circumstances in the environs of barracks.

Orders to provide suitable latrines were served on 79 persons during the year, many of them being owners or managers of large properties. The difficulty in properly enforcing the orders, and the influence of improved sanitary conditions in the reduction of illness from causes other than ankylostomiasis, have already been referred to.

In the past two years or so there has been from time to time publication of fact, theory, and opinion about hookworms and disease resulting therefrom in Natal, in the daily press and otherwise. There has been much disagreement, some writers representing the conditions as very serious indeed, others on the contrary endeavouring to show that it is of no importance at all. The people generally doubtless have

and will continue to take a middle view, and so will get at the true facts of the case.

*Leprosy.*—No new cases in Europeans came to knowledge. Five free and 14 indentured Indians were certified to be suffering from the disease, and 15 were sent home to India; 3 died and one could not be traced.

*Cancer.*—The death-rate is higher than it was five years ago, and is increasing in Europeans and in Indians. In both cases this is reasonably explained by the increase of the number of persons past middle life in both races, and in the latter also by the fact that greater attention is paid to the diagnosis of cancer since research was taken up in England.

*Pneumonia and Bronchitis* caused far less than the average number of deaths, although the former produced a heavy mortality in Indian children in some parts of the coastal area particularly. The winter was milder than it has been of recent years.

## Health of the Native Population.

It is desirable to draw attention generally to a few matters which have an important bearing on the possibility of collating any reliable information on this important subject, and to the need, in the interests of the country at large, of giving increased attention to the conditions affecting the health of the natives.

Vital statistics form the basis of all public health work, that is, work undertaken by the State for the removal or mitigation of conditions unfavourable to good health and longevity, and for the purpose of enabling the people to combat them.

Before anything can be done to amend the conditions it is essential to know the causes which injuriously affect the people, and, speaking broadly, to enable the causes to be ascertained, the effects must first be ascertained. That is to say, certain facts must be established. The larger the number of the facts, and the more precise their quality, the surer is the prospect of arriving at a sound estimate of the causes.

For the very crudest estimate to be made, one must know the numbers of the people in different sections of the country, the number of births and deaths, and the causes of death. Even for this, however, all the facts are not available for all of the country, and only one of them for a large part of it.

In April, 1904, a census was taken, and the number of natives living, tabulated in certain wide age periods, was published for each district.

Act 25, 1902, provides for the registration of the facts of birth and of death. Unfortunately, however, it has not been deemed advisable to put this Act in force in Zululand, which comprises about two-sevenths of the area of the Colony, and carries rather more than three-fourteenths of the native population.

The regulations under Act 25, 1902, provide for the registration of the age at death, and the cause of death. The latter is, however, of little practical utility, for, above the fact that the determination of the cause of death is not based on skilled knowledge, the statement itself has to pass through three persons. The kraal head informs the "official witness," who in turn informs the magistrate's clerk, and he records the cause under such heading as appears to him advisable. It is naturally impossible for the clerk to attain any degree of accuracy. It might, however, be possible to make some use of the records as showing in the roughest manner the region of the body in which symptoms of disease in the last illness have been chiefly manifested.

Seeing that the official witness receives the liberal fee of 1s., which is fixed by the Statute, for each birth or death registered, there is little chance of the facts being understated in the registers.

Of the three essentials for determining the conditions of the people in Zululand, only one is available. In other words, there is no record whatever by which the bare facts of the death-rate and the birth-rate can be even roughly estimated. Among other and greater disadvantages this renders it impossible to attain a satisfactory estimate of the population at any given time, which is otherwise easy of attainment, seeing that there is little or no permanent migration to disturb the increase, which is, in such case, the excess of births over deaths.

For Natal, apart from Zululand, it was ascertained that, in the four and a half years following the census of 1904, the population had been increasing at the ratio of 1·87 per cent., at which rate it would be doubled in thirty-seven years.

In the year 1909, although there was a fall in the registered birth-rate, this was more than compensated by a substantial decline in the death-rate, and the ratio of increase was actually a little greater than it would have been had the birth- and death-rates of the previous year continued.

One has no means of estimating the present population, nor the ratio of annual increase, in Zululand, with the same satisfactory approach to precision which is possible in the rest of the Colony. It has been my practice in annual reports to assume that the annual increment is similar in each part, but there is a considerable margin of probable error because it is very likely that in some considerable part of Zululand the birth-rate is lower and the death-rate higher. In the northern districts of that province the belt of low-lying land between the sea and hills is much wider than in Natal, and partly on that account, and largely because of the nearer proximity to the Tropics, malarial fever, which is occasionally epidemic in Natal, is endemic, and almost perennial, whilst it is also probable, although no investigation has yet been made, that other so-called "tropical diseases" prevail, with which the southern parts of the Colony are not afflicted. These diseases not only cause considerable mortality, but they tend also to diminish fertility. If the births and deaths had been registered there for the past six years the effects of such diseases could have been roughly estimated.

I do not know for what reasons registration of births and deaths has not been carried out in Zululand, but unless the reasons were, and are still, very cogent, it is highly desirable that the Act should be put into force there.

In respect to the prevalence of infectious disease

again, precise information is sadly deficient. I employ the term infectious as covering all ailments which are communicated from the sick to the well, whether directly by contagion, or mediately through a vehicle animate or inanimate. Some of these diseases, such as syphilis, are spread by contact of the infected with the sound, some, such as small-pox, through the medium of air, enteric fever through the medium of food-stuffs, and others through the agency of insects, such as malarial fever, and other conditions which, being more common in tropical regions, and unknown in the colder climates, are generally termed "tropical diseases."

In Annual Reports it has been customary to state that certain diseases, such as measles or whooping-cough, have been reported as prevalent in certain districts. For the most part such statements are rather bold generalization from few known instances. Sometimes, however, the propriety of the generalization can be supported by circumstantial evidence, as, for instance, in 1908, it was shown from the registration records that the mortality in certain districts was above that of the previous year, and that the increased mortality occurred principally in children of ages when such diseases are dangerous to life, and that the increased death-rate was, generally speaking, found to have fallen on those districts in which those diseases had been reported as prevalent.

Estimates of the prevalence of particular diseases amount, as said, to no more than a generalization. For the most part natives do not resort to European doctors for treatment of illness. The District Health Officers, perhaps, encounter a few cases of the minor infectious diseases, and they hear from natives that the like diseases are prevalent among the children in certain parts, when they are holding gatherings for purpose of vaccination. Apart from such sources of information, little is heard of particular diseases unless they become exceptionally prevalent, or cause considerable mortality in circumscribed areas. The circumstances are then reported to the magistrate, and the Health Officer visits the place and investigates the matter.

Such outbreaks are generally found to be of dysentery or enteric fever.

It is, in fact, principally by such means that the occurrence in important degree of enteric fever in natives at their homes is known, but it would only be when several deaths occur about the same time that the matter is reported at all.

Small-pox is well known to natives who recognize their obligations to report its occurrence, and it is unlikely that it is not reported when it occurs, because it would almost certainly spread to an extent at which it could no longer be concealed.

There is reason to think it probable that, in the northern parts of Zululand, besides malarial fever, other of the diseases classed as "tropical" occur. The natives in these parts blame a tick, the *Ornithodorous moubata*, for causing fevers. This tick is the agency by which relapsing fever is spread in Central Africa. There is also another disease well known to them by the name "isigwebedhla" and by other local synonyms, which appears to cause considerable distress in summer and autumn, and to be attended with considerable fatality. It appears that this term, in common with many others, is very loosely employed, and embraces several conditions having little or no pathological relation the one to the other. It is reported to occur in Tugela Valley in malarial seasons, but its endemic home appears to be north of the Umfolosi River.

The essential feature of isigwebedhla appears to be a gangrenous or destructive inflammation of the rectum or termination of the intestine, which shows a tendency to spread over the skin of the nates, and to involve the genitalia. It is attributed by magistrates and others to biliary fever, by which probably is meant "bilious remittent," a severe form of malarial fever. But this condition occurs in many parts of the world, but from nowhere is it reported to produce the like conditions. Manson, however, in in his classical work on tropical diseases, reports, on the authority of Dr. Ackers, one time resident in Venezuela, a similar condition as occurring in the hot damp regions of the north of South America, in children only, and attributed by the people to chewing the stalks of green mealies. On present information it is not possible to form any opinion as to whether "isigwebedhla" is a disease of itself, resulting from a definite and specific cause, or a complication or consequence of some other disease.

On several occasions I have urged the desirability of investigating the matter, but lack of available funds has always proved an obstacle. This year, however, the Department of Native Affairs has allotted £300 for the purpose. The investigation will be undertaken by Dr. G. A. Park Ross, District Surgeon of Nqutu, who has had thorough training in modern methods of scientific investigation, and valuable personal experience in Central Africa. £300 is a very small sum with which to enter upon such an inquiry, but it is hoped that information may be obtained, which at least will be of value in indicating the utility of such investigations, and the line along which, in future, they may be most profitably directed.

As I have previously stated, very little is or can be known about the extent of prevalence and the nature of diseases in the people. But from the scanty store of information, year by year is accumulating more evidence proving the inter-action of black and white, one upon another, in the spread of disease. The native is a potent agent in the causation of enteric fever, and of some of the minor infectious diseases which chiefly affect children. The actual number of instances in which proof is attainable is small; it is difficult enough to trace an outbreak of illness to its origin even when occurring in Europeans: it is infinitely more difficult and uncertain when the source is a native, who is unlikely to be attended by a doctor. Further, many persons suffer such slight illness that they are prevented for a few days only from following their ordinary avocations. One of the latest outbreaks traced to a native was of scarlet fever in a girls' school. The first girl in the series to be attacked came from a distant part of the Colony.

The origin of her illness came to light, one might almost say, accidentally. It was found that a native woman employed in the house had been absent a few days troubled with a sore throat; she also worked at two other houses, in both of which cases of scarlet fever occurred at about the same time. The native woman had been ill of very mild scarlet fever.

The disease syphilis affords another good example. The white man introduced it into South Africa; the black is now repaying him by passing it back to his children through the Native nurse-girls. Fortunately, however, such occurrences are occasional only.

It would serve no useful purpose to continue quoting instances of such things. The only present remedy is in the hands of the employers of native servants, who should, so far as possible, ascertain that servants are in good health when engaged.

The diseases which are of prime importance to the future welfare of the natives are tuberculosis and syphilis, and in the northern parts of Zululand malarial fever. Leprosy is not of anything like the importance of tuberculosis and syphilis in the actual amount of sickness and death which it causes, but it merits that closer attention be paid to measures for limitation than has been done so far. It is a disease which is communicated from the sick to the well, and the communication is prevented by isolation of sufferers. It is not improbable that the disease will increase its incidence, unless more regard is paid to it; and there is the advantage in dealing with it that all white people, and some natives too, regard it with horror, and thus public sympathy is in favour of dealing with it. I consider, however, that fairly satisfactory results might be obtained by something short of incarceration of the sufferer, separated from relatives and friends for the remainder of what may prove a tolerably long life. But these and like matters can be better discussed under the heading of this and other diseases.

The population for 1909 increased by 2 per cent. over 1908, the total births by ½ per cent. only, and the ratio of births to 1,000 persons living fell 4 per cent. A reduction in actual number of births registered is observed in 20 of 27 registration districts, and in eight the reduction is considerable, ranging from 30 per cent. in Impendhle and Lower Umzimkulu to 10 per cent. in Inanda and Ndwedwe. In four of these eight districts there was a remarkable rise in the number of births registered in 1908 as compared with previous years, which is compensated by the fall in 1909. The total increase of population is estimated by the balance between registered births and deaths in the five years, amounting to 8 per cent. from 1905 to 1909. The increase in the number of "kraals," however, is 16 per cent. This so far suggests that, despite the attraction of the fee, there is neglect in some districts to register the facts.

If the rates as registered reflect the actual facts, and the relatively large numbers in some and small numbers in others are due to such migration, the higher rates should be found in those districts in which the increase of kraals has been greatest. Of the 27 districts the increase of kraals was at the mean (16) in one, above the mean in 10, and below it in 16. In five of the former the birth-rate was above the mean and in five below; and of those five, in three the increase was 43 and 39 and 27 per cent. respectively. On the other hand the four districts showing highest birth-rates were below the mean in increase of kraals, and three of them very much below the mean. From this it is evident that alterations in local populations do not account for the differences: no sound reason can be suggested for them, and one is driven to suspect that in some of the lower numbered, registration is imperfect. This suspicion is supported by the fact that in seven districts the birth-rate for the five years, allowing for a natural increase in the population, on which it is calculated, is below 35 per 1,000, despite the fact that in two there has been a considerable accession of population by immigration. A rate below 35 per 1,000 is low for a people not yet influenced by the ailments and devices of civilization. The lowest rates are: for Newcastle 34, Inanda 33, Mapumulo 32, Utrecht 31, Vryheid 26. The highest rates are: Alexandra 47, Lower Umzimkulu 47, Polela and Underberg 49, Alfred 54, Richmond 55.

Of the total births 2,241 were registered under Law 16, 1867, being children of persons married by Christian rites.

The deaths registered numbered actually 628 less than those registered in 1908, being a reduction of five per cent., despite the increase of the population as at the middle of the year by 2 per cent., as compared with 1908. The rate as per 1,000 living has fallen by 1·20, and at the rate of 8 per cent. If the death-rate of 1908 had been maintained there would have been 14,249 deaths, or 919 more than were registered. It is worthy of note that there has also been a great diminution in death-rate of both Europeans and Indians.

If the infantile death-rate had continued the same as in 1909 there could have been 5,006 deaths of children under 1 year old. There was thus a saving of 536 lives under this age group. There was also a saving of 271 under age period 1 to 10 years, making a total for the two of 807. In the report for the year 1908, it was shown that the increased number of deaths registered in small children could be accounted for by the greater incidence of whooping-cough and measles, which was reported from most of the districts in which the deaths had increased. In the year 1909, however, in the reports of the District Health Officers, with few exceptions, these diseases receive no mention or are stated to have displayed small prevalence, from which it appears that the lower death-rate is principally due to the low incidence of these diseases. The District Health Office of Impendhle makes particular mention of use of feeding bottles as a prospective cause of a higher infantile mortality, and suggests the desirability of placing restrictions upon the sale of them. There can be no question that an extensive use of feeding bottles will cause a higher death-rate of infants, when used by a people ignorant of the principles of real cleanliness, and that restrictions would be desirable and proper. But one must first ascertain whether the use is increasing generally or only in local areas.

**Colonial Medical Reports.—No 8.—Natal** (*continued*).

There was a considerable increase in deaths of persons over 60 years.

The mean death-rate for the five years is at the rate of 177·6 per 10,000 living per annum. The range has been from Richmond 259 to Utrecht 131. The difference is possibly in part due to a difference in the age and constitution of the population in different districts, as to which there is no information available, but it is, of course, influenced by the birth-rate. A high birth-rate and a high death-rate go generally together, due to the fact that infants and children under 5 years are so much more liable to death than those of any age group under 65. For instance, in England and Wales, 1891-1901, death-rates were for children under 5, 577, 5-10, 43, 10-15, 25 per 10,000 of the age living, while the higher rate is not reached again till the group of 65 years and upwards.

It appears that the crude expectation of life is greatest in Impendhle, Newcastle and Umvoti and least in the coast districts. The former are generally commended for their amenities of climate, while the latter, approaching in mean temperature and humidity to the conditions known as tropical, are better known for the tendency of the inhabitants to suffer from dysentery, diarrhœa and malarial fever in years of epidemic incidence, There are, however, many factors influencing death-rates in different and lesser degrees, as to the extent of the influence of which in natives of different districts nothing is known, and beyond the broadest indication no detailed deductions would be reliable.

From reports of district health officers, it appears that the year 1909 was exceptionally favourable. The usual request for information of any special sickness, or any increased amount of ordinary sickness has elicited very few statements. *Measles* is mentioned in two districts only, Alexandra and Umlazi, and that only to state that there was little *whooping-cough* reported epidemic in Waschbank, but cases few in number in Alexandra. An exceptional prevalence of *influenza* was noted in Ngotshe. *Pneumonia* was epidemic in Lower Tugela.

Malarial fever is reported as having been exceptionally severe in Ingwavumaf Mtunzini, Ngotshe, Vryheid, and Paulpietersburg, which practically means all the country north of the River Tugela, whereas in the parts south of the river either no mention is made of it or it is expressly stated that few or no new cases were encountered. It is somewhat remarkable that in the years when malarial fever was epidemic in the Southern parts, the incidence was slight in the Northern districts.

This disease is apt to produce serious evil on the race, both by diminishing fertility and by causing physical deterioration. A great deal might be done to help the people to combat it, by affording to them facilities for purchasing quinine at a small cost. At present this valuable drug can only be obtained at the stores, where no doubt the retail price is high even if not prohibitive. It is possible by ordering large quantities to obtain quinine from the best firms at a price which admits of its being sold for 2s. 4d. an ounce, without loss and with only a fractional margin of profit. That means a cost of less than ½d. for each small, or about ½d. for each ordinary dose for an adult, or a maximum cost of 1½d. per diem for treatment.

If in the northern districts of Zululand it could be arranged for quinine to be issued on payment of 2s. 3d. or 2s. 6d. for an ounce bottle at all police stations, or even at every Magistracy, and if this were made known widely to natives, together with some information as to its merits, it is probable that there would be a considerable demand, to the great advantage of the people.

*Tuberculosis.*— The number of cases seen by District Health Officers fluctuates from year to year, and little specific mention of it is made in the Reports for 1909.

The actual numerical incidence on the total population is not at present grave, but it is certainly increasing, it will certainly increase with gathering strength, and it will, in time, produce disastrous effects.

It is spreading in the native kraals and among persons who do not work in the towns. The following from the District Health Officer, Alexandra (Dr. Bonfa), is very significant: "The cases among the natives were of local origin, and generally some other cases could be traced among the relatives. It is my experience that native patients with tuberculosis generally communicate the disease to others in the same kraal, and this depends from the fact of indiscriminate spitting inside the huts." Dr. Knight, District Health Officer, Pinetown, informs me that 24 per cent. of his native patients (a large number), treated in 1909 were suffering from tuberculosis diseases, and more than half of those from phthisis. That, however, is not to be taken as a fair index, as Dr. Knight himself says, because there are reasons for a large proportion of his cases being chronic invalids, who have obtained little satisfaction from other sources.

Tuberculous disease in South African natives has been subjected of recent years to very free discussion at official conferences, and medical congresses, and in the medical press. There is pretty fair unanimity that the most important fount of new cases, and of first cases in a domestic chain, is the inferior accommodation, the overcrowding and the circumstances of life in towns and labour centres, and that the source of infection is almost always human. In this connection it is somewhat interesting to observe that there is a tendency in Europe and America to attribute tubercular disease of the lungs to infection of human origin, and tubercular disease of the lymphatic glands to infection of bovine origin. The Veterinary Department affirms that tuberculosis does not occur in indigenous cattle in Natal, while the restrictions at the port of entry would prevent imported infected cattle from getting into the country. And yet in

some parts, *e.g.*, Umvoti county, tuberculosis disease of the glands is reported to be very common.

In regard to remedial and preventive measures there is a consensus of opinion that the character of the accommodation provided for natives at work, and especially for natives in the larger towns, ought to be improved, and the conditions in which they live maintained under better supervision. For the rest there is some difference of opinion between those who expect great results from sanatorium treatment and those who regard the prospects of such results with sceptical and pessimistic eyes. One thing is certain, and that is that no serious obstacle can be laid to the oncoming tide of tuberculosis except by educating the people themselves to an elementary knowledge and an appreciation of the disease, its nature, and its method of extension from person to person. In such education a short stay in a sanatorium would prove an invaluable object lesson.

It must, however, be admitted that the chances of instilling such an appreciation into the raw uneducated native mind are not likely to be productive of rapid and brilliant results, but by perseverence, good will certainly be ultimately effected. Some years ago a short leaflet was prepared by the health officer of the colony and translated into Zulu for use in schools, but the schools are few and the circulation very small. More recently an excellent pamphlet on consumption has been produced by a native hospital orderly at Lovedale. Dr. Neil McVicar very kindly had an English translation prepared for the health officer for the colony and subsequently a Zulu version. The latter is still with the Department of Native Affairs for approval or revision. When finally dealt with it has been arranged to obtain several thousand copies, which the mission stations have agreed to distribute. If it becomes known to the natives that the pamphlet is written by a South African native it may be that they will take interest in it; if they do so, and if they assimilate just a modicum of the information, and act on it, it must prove advantageous. But if any really satisfactory result is to come out it will be manifest only after many years of persistance and insistance.

*Syphilis* beyond question is doing serious damage to the people. It is more prevalent in some parts than in others, but it is met with from end to end of the country. There is urgent need to deal with it effectively, and the more urgent and the more important because it involves all sections of the people. Here there can be no question of morality, and countenancing immorality, and the many reasons given for ignoring the factors which produce syphilis in Europe and America. The people are a primitive people, moral in the main according to the theories of morality which find a place in their code of ethics. Their ignorance would be reason enough for affording them protection in any case, but, in fact, the disease involves not only the loose living young blood or the misguided or vicious woman, nor are its ravages confined even to husbands and wives of offenders, or children inheriting disease. There is abundant evidence to show that syphilis in South African natives spreads in families often with the facility of diphtheria, and more readily than tuberculosis, and attacks those who are quite innocent of sexualism, at all ages from infancy to senility. It is evidently frequently contracted by indirect infection, from table utensils, drinking vessels, towels, &c.

There is no room for doubt that if the matter were properly handled much good could be effected. Sufferers should be induced if possible, or failing inducement, compelled to submit themselves to suitable medical treatment both for their own sakes and that of the community. The co-operation of chiefs and leading men would be necessary, but this could be secured if the matter were properly explained. Legislation or regulations under the code of native law would be required, making it the duty of all persons to report all cases of syphilis and gonorrhœa, requiring them to submit themselves to continuous treatment, and in default of their doing so to enable defaulters to be removed and kept in confinement in a hospital for the purpose, which might for convenience be established at the leper location, though, of course, in a separate part of the ground.

*Leprosy.*—The number of inmates is the same as last year. Owing to the restricted allowance of money only eight lepers have been moved to the Location in the past two years.

There is no means of knowing with anything like accuracy the number of lepers in the colony. A rough estimate would be 450, of whom 66 or about $\frac{1}{7}$ are segregated in the Location. It may be regarded as certain that the number of lepers has increased, and that the increase continues; it is not rapid, however, and the totals are not at present very serious. No organized attempt has been made to deal effectively with the matter, and of late years the short funds allotted have prevented the removal even of cases of whose removal there was urgent need.

In the year 1909 the second International Scientific Conference was held at Bergen. The following Resolution, *inter alia*, was passed:—

"Leprosy is a disease, which is contagious from person to person, whatever may be the method by which the contagion is effected.

"It is desirable to isolate lepers.

"Lepers should not be permitted to follow certain occupations which are particularly dangerous in respect to the contagion of leprosy.

Healthy children should be separated from leprous parents.

The British and Colonial delegates issued a statement approving the Resolutions and putting forward certain additional Resolutions, of which the following are of most importance:—

"Leprosy is not due to the eating of any particular food such as fish, and there is no evidence that it is hereditary. The most important administrative measure is to separate the leprous from the non-leprous by segregation in settlements or asylums. In settlements home life may be permitted under regulation by the responsible authorities."

The notes submitted by Dr. Murray, of Capetown, who represented the Cape Colony and Natal at the Conference, indicate that the intention of the last sentence was to recognize that the great practical obstacle to segregation is the rupture of family ties, and to affirm that satisfactory results may be expected from some modification of the rigours of separation.

It is a terribly cruel thing to remove a person altogether from association with the nearest and dearest kin, and to continue the separation practically for life, for at present it is only in a small proportion of all cases that the disease becomes sufficiently arrested to admit of the person's discharge. It is a very different thing from the isolation for a few weeks of a person suffering from acute infectious disease, such as small-pox or diphtheria. Further, in the case of uncivilized races it is not practicable to restrain men when separated from their families and particularly their women, and when the sexes are kept separate, excepting under what are practically conditions of imprisonment.

At the Leper Location at Amatikulu there is not even a cattle fence to prevent persons going out, and only two native guards maintained to keep a watch against straying. When the location was first utilized in 1903 a small number of healthy persons were permitted to accompany the lepers, but of late this has been stopped excepting in an occasional instance. The number of adults of the two sexes is almost equal, and many have entered into relationships. The inmates live in small kraals of grass huts and keep fowls and goats, and do a little, but only a little, in the way of cultivation. There have been several escapes, some single, some of two or more persons in company; about half have been captured and sent back, and half are still at large. The reasons assigned have generally been that the men wish to get back to their family, and to see their friends or to get news of family affairs.

If a policy should be adopted of seeking for lepers, and segregating all persons discovered to be infected, and if the policy included the removal of the individual only and his detention in an asylum or institution, there is no doubt that natives would conceal cases to a very great extent. If, on the other hand, they were placed in settlements where they could enjoy some degree of family life, and occasionally get news of the outer world, there would not be the same desire for evasion.

It would be practicable to attain a sufficient degree of segregation at least from the outside world if three or four settlements were established in different parts. Sufferers could then remain in a part of the country, in a climate and at an altitude to which each is accustomed, and the place at which they lived would be reasonably convenient of access to relatives and friends who wished to communicate with and see them from time to time.

The healthy wife or husband, as the case might be, or the mother of a leprous child, if they desired it, and other healthy near relatives, such as children for whom no other suitable arrangements could be made, would be removed with the sufferer. The family would be provided with two huts, and would live an ordinary life, subject to observation of the rules. The principal rules to be observed for limiting contagion would be that no infected person should prepare food for the healthy, and that the leprous and non-leprous should not eat together or sleep in the same hut, excepting in the case of a mother and small child. It would, of course, be impossible to prevent cohabitation of husband and wife. No inmate would be permitted to pass over the boundaries of the settlement or location. The penalty for wilful negligence of any of such rules would be removal for a time or permanently to an asylum, or a more distant settlement, such as the Amtikulu location. Unattached lepers would be encouraged to form marriage connections together. So far as practicable the children of lepers would be removed early in life, but consideration would have to be extended to the susceptibilities of the parents.

Such settlements would need to be reasonably near to a railway, for facilities of transport, and to a magistracy for provision for some medical treatment, and under the direct and continuous supervision of a suitable white superintendent resident at the place.

The adoption of a plan such as outlined, of modified segregation would give as satisfactory results as a more rigid system, with natives of this colony. With a lessened desire for evasion of removal, the conditions at the settlement being less repugnant than at an asylum, or a remote location like the Amatikulu, a far larger proportion of lepers would come under supervision, and the general public would enjoy better protection, as against the disadvantage that there would be more children born to lepers, and some of the relatives who, with a system of complete segregation might escape infection, would be infected. The relatives might be the losers, but the general people would be the gainers, and the lepers would be relieved of much misery, for the infliction of which the only justification is the plea of absolute necessity that one should suffer for the advantage of many. But if, as appears probable, the people in general could obtain an equal degree of protection in the aggregate without causing such misery, there can be no objection to the adoption of the more humane methods. At least it would be worth while to try one settlement in the upper districts of Natal.

A source of repeated and urgent complaint by the lepers at Amatikulu is that they receive no systematic medical treatment. Under present arrangements the District Surgeon visits once a fortnight, and at other times when required. The climate is hot and moist, the distance from Mtunzini is 27 miles, and it is not possible to undertake any such treatment without some suitable accommodation for personal rest and for seeing patients. Really systematic treatment, with the object of testing the value of new remedies, could not be carried on except by a medical officer residing at or very near the location. If, however, suitable accommodation were provided, more frequent

visits could be made, and something better done to satisfy the inmates, and to make the best use of presently employed remedies.

The expenditure on account of leprosy in natives in 1909 was £1,355. The sum allotted in the financial year 1908-9 was £1,450 for dealing with leprosy in all races. As previously stated this rendered removal of further cases impossible. A further amount of £1,150 is voted for the current financial year, which is estimated to be sufficient to provide for the examination, removal and maintenance, with share of other expenses at the Location, of 50 to 55 natives. The Supply Bill was passed so late in the financial year that it will not be practicable to remove so many in the year.

*Vaccination.*—There are two particularly unsatisfactory features in connection with vaccination, *i.e.*, of conscientious objectors and the number unaccounted for.

No less than 32 per cent. of the parents in Durban sent in depositions signifying a conscientious objection. It is scarcely credible that 32 per cent., or even 11 per cent., have really conscientious scruples, that is to say, believe they would commit a breach of their own moral code, or alternatively that they would inflict indelible injury upon their offspring, by subjecting them to vaccination. It is to such persons only that the Act intends that relief should be extended; but unfortunately the wording of the clause allows for considerable elasticity of conscience. The parent is required to depose that "he conscientiously believes that vaccination would be prejudicial to the health of the child." During the progress of a successful vaccination there is, of course, an interruption, though of short duration only, of the previous condition of well-being. The forms on which the depositions are made explain fully the intentions of the Act, but parents apparently prefer to take advantage to the full of the wording. It is sufficiently evident that, in many cases, parents are, to say the least, straining their consciences, from the fact that numbers of persons have covered their declaration with a letter indicating that, while believing in the advantages of vaccination, they think that it would not be good for the child as it is "teething" or "about to cut teeth"; while others have admitted that they made the declaration because the disturbance of the child's health which will ensue for a few days is such a worry in the house.

The Act requires that the declaration be sent in within four months after the birth of the child, while allowing six months for vaccination. A certain proportion of parents do not think of lodging a declaration, until, at the end of five months from birth, a notice is sent reminding them of their obligations, and warning them that neglect to carry them out will entail a prosecution. No less than forty such parents, on being informed that the declaration was lodged too late to secure them against a penalty, have preferred to get the child vaccinated rather than incur the penalty: that is to say, that their scruples are not proof against a fine of 10s. or so.

The number of parents who lodge declarations of "conscientious objection," especially in the town of Durban, has now attained such dimensions that it appears necessary that some amendment should be made in the Act. It is farcical to call vaccination obligatory if one parent in three is to be absolved from obligation. There are three choices: (1) to make vaccination voluntary only, and to put up with recurrent epidemics of small-pox; (2) to repeal the conscience clause altogether, in which case the magistrate could take into consideration the plea when the parent came before him for neglect of his obligation; The parent would have to suffer for conscience sake; (3) to alter the wording of the clause so that only persons having genuine scruples could take advantage of it.

The large proportion of children unaccounted for outside the large towns is due in great part to the fact that the parents live in places where the services of the Public Vaccinator are not available, and the services of a private practitioner very expensive. No proceedings have, up to the present, been instituted against persons in rural areas. In the two big towns a number of persons against whom charges were made were not found for service of summons, while others who were convicted and fined appear to have overlooked the fact that a penalty does not absolve them from obligation, but that at the end of six months, if the original requirements of the law are not met, they again become liable.

The vaccination of Indians is in a more satisfactory position. Approximately 60 per cent. of infants who have become liable since the Act of 1906 came in force, have been vaccinated, as compared with less than 40 per cent. of Europeans. The proportion of the former would have been much higher, but that no funds were available for any vaccination of Indians in 1908. Parliament voted £1,000 only for vaccination, and the Treasury caused nearly the whole of it to be utilized in payment of fees earned in the preceding financial year, for which accounts were not presented in time for payment in that year.

49,194 native children were vaccinated, which is short of the number of children who have reached the age of 6 months since the preceding tour of the District Vaccinators by about 11,000. So large a deficiency would have been avoided had funds been provided for vaccination in 1908. In 1904 small-pox was epidemic, and over 370,000 natives were vaccinated. Since then it is estimated that, in round numbers, 130,000 children have passed the age of 6 months and are still alive, of whom about 100,000 have been vaccinated, and 30,000 are entirely unprotected against small-pox.

About £3,000 per annum is needed to cover the expenses of efficiently vaccinating all classes of the community, and to allow of payment of a reasonable remuneration to Public Vaccinators. The sum allotted by Parliament is £2,500, and the deficiency has to be met by keeping the fees of vaccinators at an unreasonably low figure.

*May* 21, 1900.

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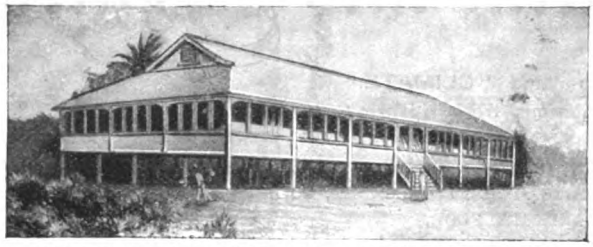

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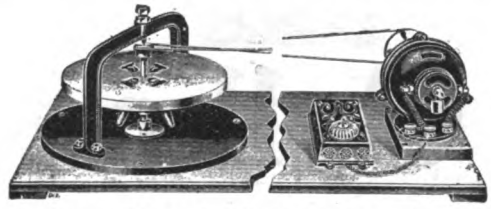

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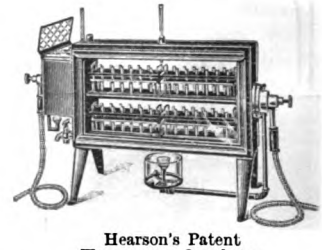

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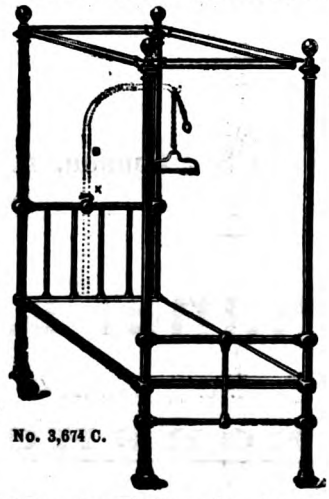

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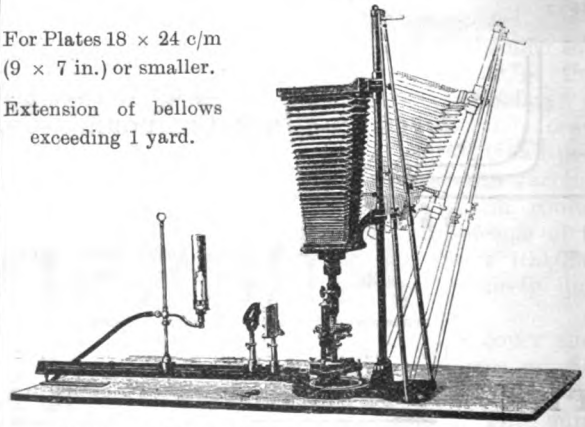

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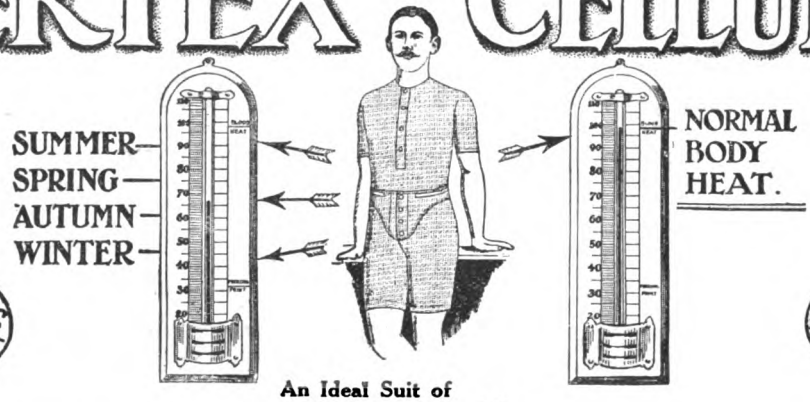


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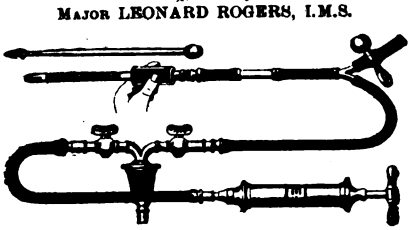

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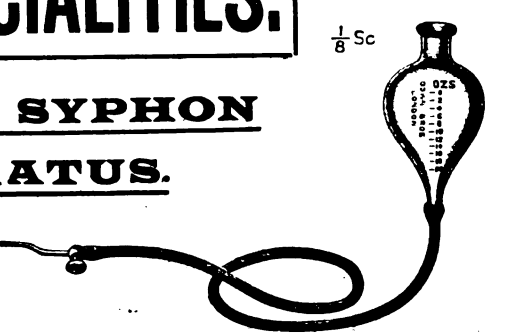


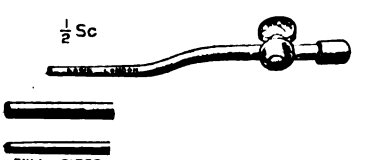


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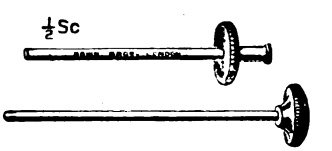


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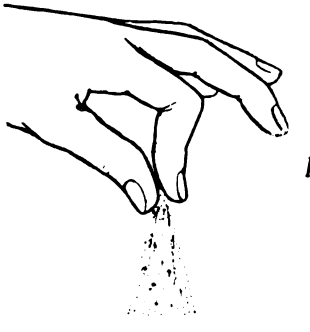

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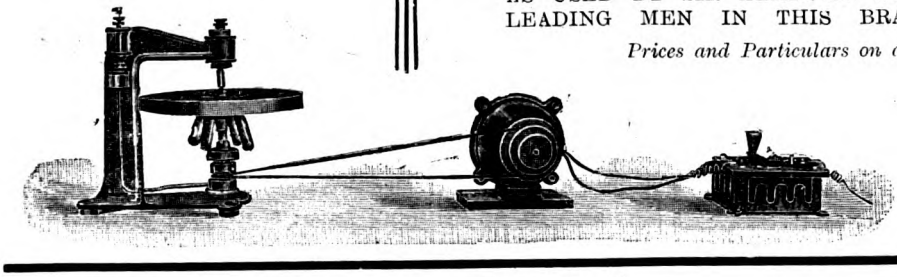

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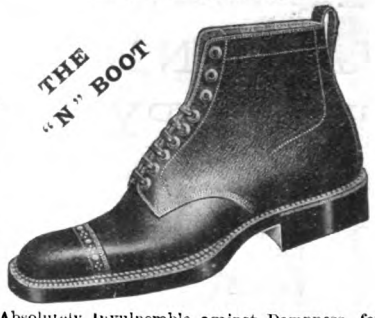


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An eminent Anglo-Indian Physician says:—"APENTA Water is the only Aperient which can be taken by those who suffer or have suffered from DYSENTERY."


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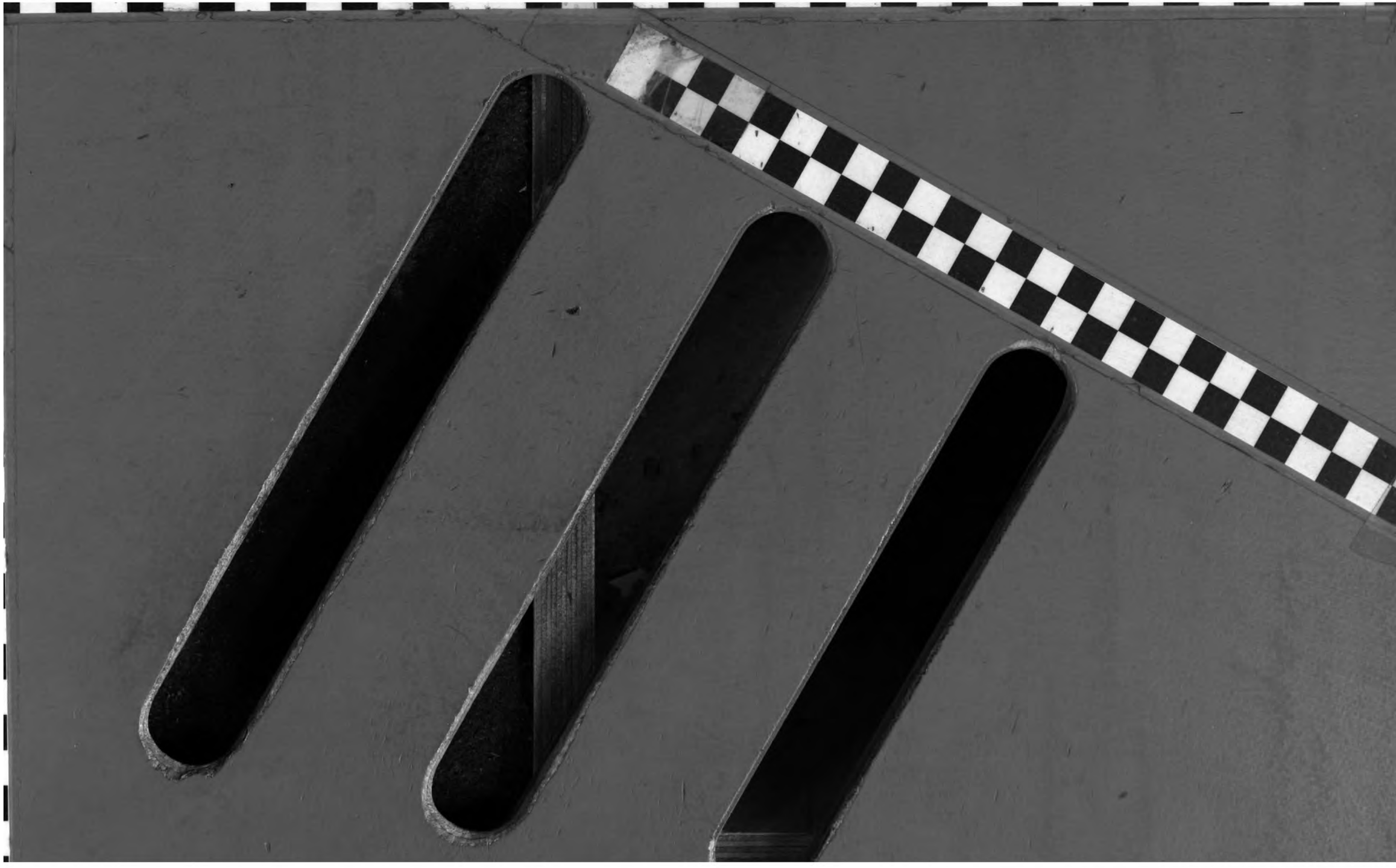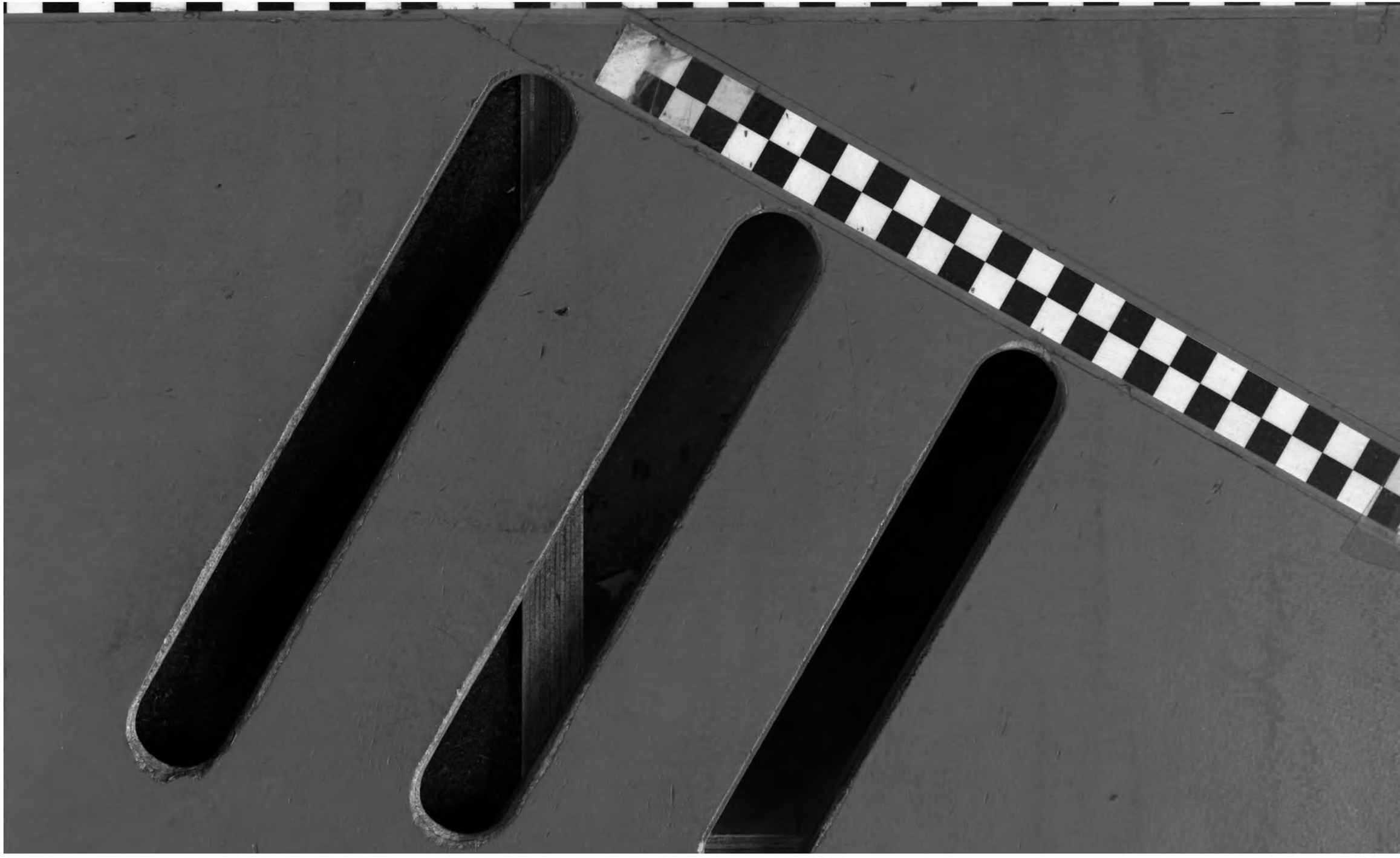
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